NATURE

SATURDAY, MARCH 14, 1925.

CONTENTS.

Editorial and Publishing Offices:
MACMILLAN & CO., LTD.,
ST. MARTIN'S STREET, LONDON, W.C.2.

Editorial communications should be addressed to the Editor.
Advertisements and business letters to the Publishers.

Telephone Number: GERRARD 8830.
Telegraphic Address: PHUSIS, WESTRAND, LONDON.

NO. 2889, VOL. 115]

Oceanic Research.

IN his presidential address to the British Association at the Cardiff meeting of 1920, the late Sir William Herdman suggested that the time had come for a new deep-sea expedition on the scale of the *Challenger* voyage of 1872–74. This proposal was discussed at various Association meetings; a tentative scheme was approved and was then submitted for the consideration of other scientific bodies. The time, however, was regarded as inopportune and the proposal was not taken up. Now, it appears, the movement may come from the United States.

In 1923, Dr. H. C. Hayes, of the U.S. Navy, developed a very ingenious method of taking almost continuous ocean soundings by means of a sound-wave transmitted to, and reflected back from, the sea bottom. This "echo-sounding" presented such possibilities for oceanographic surveys that definite suggestions were made for a national expedition, and, after considering these, Col. Theodore Roosevelt, the Acting Secretary of the U.S. Navy, summoned a meeting of representatives of government departments and extra-governmental establishments. This was held in July 1924, and was addressed by the Hon. Curtis D. Wilbur, Secretary of the Navy. A committee then prepared a report which was adopted by the conference and sent to the Secretary.

The report recommends that a vessel, with officers and crew, should be supplied by the Navy. A scientific staff, consisting of an oceanographer, a biologist, and a geologist—all men of outstanding attainments—with six or more scientific assistants, will, it is expected, be provided from sources other than government funds. The cost of the first year's work, apart from the maintenance of the vessel and the salaries of the scientific staff, is estimated at about 57,000 dollars. How long the expedition will be away is not considered, but it is contemplated that a naval vessel will be permanently employed on oceanographic research.

The problems upon which the expedition is expected to concentrate are briefly outlined—they constitute a programme which is new, in some ways, and particularly attractive. The work of the *Challenger* was very comprehensive, but, in the main, it was biological in its attitude. Now, since 1872, the science of geophysics has been developed, and more attention is being directed to the morphology of the ocean floor. Existing oceanic soundings are so few that they are of little use in detailed studies, and so the method of finding the depth by echo-sounding must be largely used in any new oceanic expedition. During the last twenty years or so, a very extensive investigation into the subject of isostatic compensation in the earth's crust has been made by

the U.S. Coast and Geodetic Survey. The work accomplished has, however, been practically restricted to the North American continent, and its extension to the ocean floor and the deeps is most desirable.

Other geophysical problems demand close observations of the precise forms and positions of the deeps—the question, for example, of the downward warping of the ocean floor along the continental margins suggests the need for great numbers of new soundings in all regions. Evidence of submarine upheavals and dislocations, and of the occurrence and frequency of submarine earthquakes and volcanic eruptions, is urgently needed. There is necessity for a renewed investigation of the deposits on the ocean floor. Determinations of mean ocean depth in chosen places are needed. Oceanic tides have scarcely at all been investigated, and even ocean currents are not so well known as they ought to be. The forms, heights, and velocities of ocean waves also require study.

Further, the great development of radio-telegraphy and telephony has suggested problems for which a much extended knowledge of electrostatic and electromagnetic fields in the atmosphere is required. Since the ocean covers five-sevenths of the earth's surface, most of this kind of investigation must be undertaken at sea. The distribution of icebergs on the margins of steamship routes is already being studied by the U.S. Government, but a great extension of the field of investigation is necessary. Now, in addition to all these subjects of investigation, there are, of course, the routine physical and biological methods of research into the ocean water itself and the fauna of the sea floor. This would be done as a matter of course, but it is very interesting to see how "up-to-date" in its attitude to growing science is the programme for this new expedition.

It is recommended that the area of investigation should (at first) be the Gulf of Mexico and the Caribbean Sea. Then the research is intended to spread through the Panama Canal and to take in the North Pacific on one hand, and the North Atlantic on the other. At the present time oceanographic investigation of the Pacific Ocean is by far the most attractive side of the subject. There we obviously have ocean basins and continental margins *in the process of making* (for in the greater part of the Atlantic something like stability has been reached, and the problems there centre round sedimentation on the region of the continental shelf). A geophysical expedition dealing with the oceanic part of the earth's surface (for that is evidently what the present trend of scientific discovery suggests) cannot afford to concentrate on any relatively small part of the Pacific and Atlantic areas—the whole of the former region requires multitudes of ocean soundings at the very least. If, then, this big American expedition begins work very soon (and there is every likelihood that it will do so), the question of co-operation ought to be considered: it is a pity that such action was not discussed, and proposals of some kind made, at the conference.

At all events, the time is ripe for a consideration of the position of oceanographical investigation by Great Britain and other countries. For a long period now the objects of deep-sea expeditions have been very much the same as those of the *Challenger*—that is, the study of abyssal and pelagic ocean life, with the investigation of the physical conditions that influence the distribution and density of faunas and floras. Since the beginning of the work of the International Council for the Exploration of the Sea, oceanic research has had a strong fisheries bias, and, at the present time, a great deal of such investigation is actually in progress in the north European region: this is likely to develop still further its utilitarian and fishery objects, and its interest tends to become a very specialised and even an administrative one. We plead here for an interest which is much wider and should be purely scientific. During the last twenty years or so (and largely because of the original work of the International Council) oceanographic physico-chemical methods have been well developed. Hydrodynamical methods, on the mathematical side, are remarkably well developed and are far ahead of the observational side of the science. This is also the case with theoretical geophysical research: it waits for a sound and very extensive basis of observations, and that cannot be given by any amount of geological work on the land, for research on the five-sevenths of earth surface that is occupied by the ocean is urgently required.

Every consideration points, therefore, to deep-sea investigation on rather new lines, and the progress of geophysical and hydrodynamical research on one hand, and of oceanic meteorology on the other, suggest what these new directions ought to be. Now that a lead has been given by the proposed American naval expedition, it would be very gratifying if a similar British naval one could be planned out, and if it could be arranged that a large measure of co-operation of aims and methods were secured. In spite of all that has been done in Great Britain on fishery investigation, it is nevertheless true that scientific oceanography has been neglected ever since the time of the *Challenger* expedition, and we cannot see any reason why a small fraction of the resources and interests of our Admiralty should not be directed to the prosecution of pure oceanic research without a necessary utilitarian object.

Scientific Exploration in the Karakorum Mountains.

Paesi e Genti del Caracorum: Vita di Carovana nel Tibet Occidentale. By Giotto Dainelli. (Pubblicato sotto gli auspici della R. Società Geografica Italiana.) Vol. 1. Pp. viii+291+74 plates. Vol. 2. Pp. iv+323+95 plates. (Firenze: Luigi Pampaloni, 1924.) 120 lire.

THE Karakorum Mountains are of special interest, as they contain the greatest glaciers known outside the polar regions and Mt. Godwin-Austen, or K.2, the third highest summit of the Himalaya. Scientific knowledge of the country has been collected by many distinguished explorers, including the brothers Schlagintweit in 1854–6, Godwin-Austen in 1860–1, Sir Francis Younghusband in 1887, and Sir Martin Conway, who in 1892 traversed the full length of the three longest glaciers and mapped them. In 1913–14 the country was visited by an Italian expedition under Dr. Filippo de Filippi, who had accompanied the Duke of Abruzzi on his expeditions to the same region and East Africa. When de Filippi received the medal of the Royal Geographical Society for his share in these explorations, the two Asiatic expeditions with which he was concerned were described by Sir Francis Younghusband as the best led and scientifically equipped expeditions which had up to then worked in the Trans-Himalaya. The full narrative of the expedition will be given in a promised monograph by de Filippi. The present work consists of the journals of its geologist, Dr. Giotto Dainelli, and it records his personal experiences and observations. He is well known from his work in East Africa, reminiscences of which lead to his contrasts between the modest simplicity of African caravans and the large cavalcade and numerous companies of coolies of Asiatic expeditions. The work also expresses the fascination of this country as compared with tropical Africa, owing to the more advanced architecture, culture, and religious development.

The two volumes tell the story of the journey from Marseilles to Bombay, and thence through Kashmir and by the well-known road across the Himalaya by the Zogi La to Dras and to the Indus at Tolti and Skardu. Thence Dr. Dainelli made a series of expeditions through the Karakorum valleys. He reached the ends of the Baltoro and Biafo glaciers, which were surveyed by Sir Martin Conway. The nearest comparable height among the glacial endings given is that of the Biafo, which Dainelli puts at 10,049 ft. and Sir Martin Conway determined as 10,120 ft., so there had been no material movement of the end of that glacier in the intervening twenty years. Dr. Dainelli did no serious mountaineering in this district and Sir Martin Conway's maps of the glaciers are incorporated in the author's general map. Later on, in the north-eastern Karakorums, Dr. Dainelli explored some less-known regions, including the Rimu Glacier, one of the sources of the Yarkand River, and there the expedition added materially to geographical knowledge. After many journeys in the valleys south of the main glacial region of the Central Karakorums, the expedition proceeded to Leh. Dr. Dainelli shows the charm of that country by many photographs of the picturesquely placed monasteries or gompas, and his descriptions of the religious dances.

From Leh the expedition proceeded north-westward to Depsang, on part of the way using yak, which the author describes as the camel of the mountain deserts. He visited some little-known valleys, and, among other features of interest, various hot springs and salt lakes. In this district Dr. Dainelli crossed the routes of the Schlagintweits, whose work he praises highly, though in parts of this country the latest Indian map was so sketchy that he could not determine his place on it. From Depsang he explored the Ciong Cumdan and Rimu Glaciers, with their interesting moraines, glacial lakes, and stratified ice. Thence following the Yarkand River, the expedition descended, with obvious regret, from the mountains to the monotonous steppes of Turkistan. During the return journey the explorers were arrested at Moscow as German spies, but promptly released on the intervention of the Italian Ambassador; they proceeded through Petrograd and Stockholm to Berlin, which the author describes as in October 1914 apparently following its normal life.

The two volumes of Dr. Dainelli's experiences give an interesting account of the conditions under which the work of the Filippi Expedition was conducted and show what great opportunities its members enjoyed. The author describes the work as a faithful journal of his share in the expedition, and it gives useful observations on the topography and people. Its value as a work of reference is much lessened by the absence of an index, which would be especially useful where the spellings in the text and map differ, as in Olang and Olting. The expedition worked near an area of special interest in reference to the structure of Central Asia. The observations of this expedition may resolve the different interpretations of the Mustag-ata which, according to Suess, is a transverse meridional chain breaking unexpectedly across the main trend of the Asiatic ranges. This conclusion was rejected by the late Sir H. H. Hayden, who did not, however, fully explain the facts of which Suess's view was offered as an interpretation. There is but little information on these questions in the journal, though the expedition obviously collected much new material. Dr. Dainelli remarks, for example, that the Museum of San Marco

would not have space to hold their collections of fossils; but as to what the fossils are we must wait for the later monographs. Similarly, the rocks are often graphically described; but they are not identified, and the picturesque pinnacles and masses of limestone shown in the photographs are of unstated age.

The technical work of the expedition is being published in 13 parts, dealing with the geology, geography, palæontology, petrology, ethnology, botany, zoology, and geodesy. The only report yet issued is that on the glaciers, a volume with a fine atlas by Dr. Dainelli. His journal is illustrated by numerous beautiful photographs and a four-sheet topographic map on the scale of 1-750,000, which is a valuable addition to the geography of the central and north-eastern Karakorums. J. W. G.

Studies in the History of Medicine.

(1) *Essays on the History of Medicine.* Presented to Karl Sudhoff on the occasion of his Seventieth Birthday, November 26, 1923, by Sir T. Clifford Allbutt, Arturo Castiglioni, Friedrich Dannemann, Paul Diepgen, Erich Ebstein, Fielding H. Garrison, Ernst Howald, Arnold C. Klebs, E. O. von Lippmann, Max Neuburger, Sir Humphry Rolleston, Henry E. Sigerist, Charles and Dorothea Singer, W. G. Spencer, Georg Sticker, E. C. Streeter, Lynn Thorndike, G. A. Wehrli, and Edward Theodore Withington. Edited by Charles Singer and Henry E. Sigerist. Pp. v+418+24 plates. (London: Oxford University Press; Zurich: Verlag Seldwyla, 1924.) 42*s.* net.

(2) *The Doctor's Oath: an Essay in the History of Medicine.* By W. H. S. Jones. Pp. vi+62. (Cambridge: At the University Press, 1924.) 7*s.* 6*d.* net.

(3) *A Pioneer of Public Health—William Thompson Sedgwick.* By E. O. Jordan, G. C. Whipple, and C.-E. A. Winslow. Pp. xvi+193+5 plates. (New Haven: Yale University Press; London: Oxford University Press, 1924.) 18*s.* 6*d.* net.

(1) THE *Festschrift* dedicated to Prof. Karl Sudhoff on the occasion of his seventieth birthday consists of eighteen essays contributed by writers from England, the United States, Germany, Austria, Switzerland, and Italy. The essays, eight of which are in English, nine in German, and one in Italian, have been classified by the editors into the five groups of antiquity, Middle Ages, Renaissance, modern times, and general subjects respectively.

The first group contains essays on prehistorical attempts to prevent and stamp out epidemic disease, by Dr. Georg Sticker of Würzburg, the work of Philolaus, by Dr. Ernst Howald of Zurich, and the scientific treatises ascribed to Theophrastus, by Dr. Lynn Thorndike of Cleveland. In the section devoted to the Middle Ages, Dr. E. O. von Lippmann of Halle writes on the history of alchemy; Dr. Diepgen of Freiburg discusses the influence of the Middle Ages on the progress of medicine; Dr. and Mrs. Singer deal with the origin of the medical school of Salerno, which they show to be the result of combined Greek, Latin, Jewish, and Saracen influences; Dr. E. T. Withington gives an account of Roger Bacon's work entitled "On the Errors of Physicians"; and Prof. Arturo Castiglioni devotes an illustrated article to blood-letting in the arms of the Manfiedi, lords of Faenza. The third section contains papers by Dr. Henry E. Sigerist of Zurich on the birth of Western medicine; fifteenth-century miniatures of extra-mural dissection by Dr. E. C. Streeter of Harvard and Dr. Charles Singer; the "Practica of Gianmatteo Ferrari da Gradi, editio princeps," by Dr. Arnold C. Klebs of Noyon; and the "Epitome" of Vesalius on vellum in the British Museum, by Mr. W. G. Spencer.

Modern times are represented by contributions from Sir Humphry Rolleston on the reception of Harvey's doctrine of the circulation of the blood in England as exhibited in the writings of two contemporaries, namely, Thomas Winston (1575–1655) and Henry Power (1623–1668); from Colonel Fielding Garrison, on the newer epidemiology; and from Dr. Erich Ebstein of Leipzig on Frank Joseph Gall. The last group contains papers by Prof. Max Neuburger of Vienna on the history of the problem of Nature healing, parallelism in the development of the natural sciences and therapeutics, by Dr. F. Dannemann of Bonn, and the essence of folk medicine and the necessity for its historical study, by Dr. G. A. Wehrli of Zurich.

A bibliography of Prof. Sudhoff's works on the history of medicine, compiled by Dr. Sigerist, is appended.

No higher praise can be given to the volume than by saying that it is worthy of its recipient, whose services to the history of medicine are gracefully acknowledged in the preface by Sir Clifford Allbutt. The work is well printed, and accompanied by numerous excellent illustrations.

(2) Mr. W. H. S. Jones's scholarly work on the Doctor's Oath will interest alike the historian of ethics and the medical practitioner, inasmuch as medical ethics and the medical etiquette of the present day are based upon this famous oath.

After a brief account of the manuscripts of the Hippocratic collection, with an enumeration of the best manuscripts containing the oath, the Greek text of the Pagan Oath is given, with the English translation and critical footnotes. The chief variants in the later manuscripts are noticed, and are followed by a full

transcription of the Milan manuscript Ambrosianus B 113, which contains both the pagan and the Christian oath. The Greek text of the Christian modification of the oath, which in two manuscripts is written in the form of a cross, differs from the pagan oath in its omission of (1) reference to the pagan deities, (2) of all clauses in which preferential treatment is promised "to my teacher, his sons, my sons, and to those who have sworn allegiance to the physician's law," and (3) reference to a reward for instruction.

The Arabic text is also reproduced, as well as two Latin translations ascribed to N. Perotti and Nicholas of Regium respectively.

In the subsequent commentary Mr. Jones points out that though the first certain reference to the oath is in the preface to Scribonius Largus, who flourished in the reign of Claudius, there is a possible allusion to it in the *Thesmophoriazusæ* of Aristophanes, *i.e.* as early as 400 B.C. The two versions of the oath, pagan and Christian, and their variants, suggest that the document had a wide circulation. The extant evidence does not conclusively prove that the oath was ever actually administered, and Mr. Jones suggests that it was "a counsel of perfection expressed in the form of an oath, just as many sepulchral epigrams in the Greek anthology are literary efforts which have never appeared on tombs."

In an appendix Mr. Jones compares the oath with the addresses to medical students in the old medical books of India, and reproduces the oaths still in use at the Faculties of Medicine at Montpellier and Glasgow.

(3) The memoir on the late Prof. William Thompson Sedgwick, who has been called the "Father of Epidemiology in the United States," consists of a series of essays by his former pupils, Prof. E. O. Jordan, G. C. Whipple, and C.-E. A. Winslow, preceded by an introduction by Prof. Sedgwick's widow. In the first essay, which deals with the public health movement in the 'seventies, the writers, after acknowledging the indebtedness of the United States to British sanitary science, point out that public health in the 'seventies was almost wholly concerned with the problems of the non-living environment. During Sedgwick's lifetime the public health movement assumed a biological character as the result of Pasteur's researches, and the way was laid open for the development of bacteriology and immunology.

In the succeeding essay, which is entitled "The Gate of Knowledge," an account is given of Sedgwick's early life. Though he registered as a medical student he never qualified as a medical practitioner, but devoted his whole career to biology, epidemiology, and public work. His most important achievement in the field of public health, of which an account is given in the following essays, was his investigation of a series of typhoid epidemics in 1894 which occurred in Massachusetts. His next most important contribution to public health science was the development of laboratory methods for the study of the microbiology of air, water, ice, and milk. He also paid much attention to the subject of food sanitation and conservation, and laid stress on the importance of statistics in epidemiology and of sanitary engineering, chemistry, and biology in the prevention of the chief communicable diseases.

Finally, Sedgwick was well known as a lecturer in subjects relating to public health not only in the United States but also in Great Britain, where he acted in 1920 as an exchange professor in the Universities of Leeds and Cambridge. The volume contains two appendices, consisting respectively of a bibliography of Sedgwick's writings and a list of his pupils.

Applied Elasticity.

Applied Elasticity. By Dr. John Prescott. Pp. vii +666. (London: Longmans, Green and Co., 1924.) 25*s*. net.

A STUDY of elasticity lying midway between that provided by Love in his "Theory of Elasticity" and by Morley in his "Theory of Structures and Properties of Materials" has long been required—a book, in fact, for the mathematical engineer. The present work, as its title indicates, is an attempt to fill that niche, and it contrives to do so with considerable success. Incidentally it is an exposure of the narrowness of the field that has been explored mathematically with any certitude.

The first three chapters deal with the analysis of stresses, the establishment of the equations, and a few particular solutions. These are very clearly expounded. Then follows a chapter on the empirical basis of elasticity. Considering the fundamental importance of this question and how necessary it is to realise the limitations involved in the basic assumptions and therefore imposed on the results of the theory in practice, it would be reasonable to expect a considerable chapter devoted to this question. Out of nearly 670 pages, this chapter consists only of 4 pages. The next seven chapters deal with rods under tension and thrust, in torsion, rods in longitudinal and torsional oscillation, and curved rods in equilibrium. Following a chapter on spheres and cylinders come four on thin plates under various conditions of stress and one on rotating discs.

It is apparent at once that, roughly, the field amenable to mathematical analysis narrows itself down to a treatment of the simple geometrical forms—the line, the plane, the sphere, and the cylinder. Even in these

regions it is not at all apparent how far the results obtained have actual validity. When in design work, factors of safety—or ignorance—of 5, 6, and 7 are common, it cannot be expected that a piece of analysis, however beautiful or elaborate, will carry conviction unless point by point the deductions can be checked directly or indirectly by experiment. The present work, we venture to think, would have been considerably enhanced by a larger proportion of space being devoted to experimental comparison, especially for a work on applied elasticity. The limitations of the theory of Chapter vi., for example, dealing with the buckling of struts, to choose only one case, would have been apparent had some of the published results of such tests been introduced for comparison. These would have enabled one to appreciate how far the simplifications involved in assuming idealised pin-joints, homogeneity of material, and lack of eccentricity generally are reflected in the calculations. After all, it is vitally important to know how far applied elasticity can be relied upon for a prediction.

The author has apparently confined his attention deliberately to certain groups of questions. There is no mention of the many applications of elasticity to aeronautics, to wing and fuselage structures, or to twisting and vibration of propeller blades. But we must not be over-critical. He has undoubtedly produced an excellent and important contribution to the subject, not merely in the old matter which he has presented in new and refreshing form, but also in the many original investigations here published for the first time. We are grateful for it.

Our Bookshelf.

Handbuch der allgemeinen Chemie. Herausgegeben von Prof. Wilhelm Ostwald und Prof. Carl Drucker. Band 4: *Das Leitvermögen der Lösungen.* Von Prof. Paul Walden. Teil 1: Allgemeines, Grundlagen der Leitfähigkeitsmessungen, Methoden, Elektrolyte und Lösungsmittel, Überführungszahlen, Ionenchemie. Pp. ix+383. 17 marks. Teil 2 und 3: Zahlenwerte des Leitvermögens in wässerigen und nichtwässerigen Lösungen; Folgerungen, Gesetzmässigkeiten, Anomalien, Anwendungen. Pp. vi+346+v+397. 47 marks. (Leipzig: Akademische Verlagsgesellschaft m.b.H., 1924.)

THE fourth "volume" of Ostwald's "Handbuch der allgemeinen Chemie" consists of three parts, under the general heading of "Conductivity of Solutions." The first of these parts deals with methods of measurements, and general questions, such as the hydration of ions, and concludes with a long section on transport-numbers and ionic mobilities. The second part contains the numerical data in reference to conductivity in aqueous and non-aqueous solutions. The third part deals with regularities and anomalies, as well as the application of conductivity-measurements to the study of physico-chemical problems.

A quarter of a century ago, it was possible to deal fully with all these questions in a single small monograph. Thus Kohlrausch's "Leitvermögen der Elektrolyte," published in 1898, contained only 227 pages, including the table of contents and tables of logarithms, etc. The three sections of Prof. Walden's book cover 383, 347, and 397 pages respectively, apart from title-pages, etc., giving a total of well over 1000 pages. Like so much other German literature of this kind, the book is amazingly complete. Every paper dealing with the subject appears to have been noticed, and even the most distant applications are discussed with full references to the relevant literature. Thus an organic chemist who is interested in free radicals or in carbonium salts will find the relevant data duly catalogued. It is impossible not to admire the patience and skill of the author in compiling so complete a work, and its value to workers and teachers cannot be exaggerated. Its very completeness, however, makes it more suitable for use as a work of reference than as a text-book for students, unless as readers they possess the same amazing patience that the author has shown as a writer. One of the principal uses of the book will, however, be as a mine of information for those who are responsible for teaching the subject, and in this way its publication may prove of real value even to the elementary student; but it would be an alarming prospect if so complete a volume should be taken by his examiners as indicating what the scope of his knowledge should be.

The Military Uses of Astronomy. By Major F. C. Molesworth. Pp. xii + 112 + 2 plates. (London: Longmans, Green and Co., 1924.) 3*s.* 6*d.* net.

THE main impression created by reading Major Molesworth's handbook is that the task undertaken is rather a difficult one. Its object is to explain the fundamental principles of astronomy, with practical application to the simple problems which present themselves to the soldier without requiring the use of instruments. The knowledge demanded is modest enough, but to convey it in an accurate and attractive form is not easy. With the necessary deductions for full-page diagrams and so forth, this book occupies less than eighty-five pages, and, partly from its brevity, the treatment of the subject appears rather unsatisfactory. The needful familiarity with actual problems can only be gained by assiduous practice, and it seems doubtful whether Major Molesworth's little work will provide the stimulus to bring out the necessary effort.

In spite of Sir W. R. Birdwood's foreword, it seems but fair to recognise that the military uses of simple naked-eye astronomy are strictly limited. It is inconceivable that any serious operation should be left to the chances of a fine sky. There is no apparent reason why, in normal circumstances, the watch and the compass should not be used for the purpose of determining time and direction. In cases of emergency, as, for example, the escape of prisoners, readiness in making use of astronomical indications may be an invaluable resource, but only when more orthodox and trustworthy methods are not available.

This is not to be understood as discouraging in any sense the study of the elements of astronomy, which can be recommended as a thing fascinating in itself and

specially valuable alike to soldiers and to all others who are liable to find themselves removed from the normal conditions of civilised life. But it has no value which is exclusively military, and a broader foundation is desirable than will be found in this book if the more valuable sequel of practical observation is to be expected.

It should be mentioned that a special feature of the work is a set of diagrams giving for every 10° of latitude from 70° N. to 40° S. the bearing and altitude of the sun throughout the year. Something better in the way of star maps than the plates at the end of the book could easily have been provided.

A Manual for Spraying. By K. L. Cockerham. Pp. xi + 87. (New York: The Macmillan Co., 1923.) 7*s.* net.

THIS little book on spraying is intended as a reference book and guide for practical men. It is exceedingly brief, consisting of a short account of various types of spraying machines, including dusting apparatus; descriptions of and recipes for the more commonly used spray fluids; and a series of tables of insect and fungus pests, arranged under crop headings, giving the kind of injury caused by each pest and the spray recommended for its control. Unfortunately, the subject does not lend itself to quite such cut-and-dried treatment. The identification of a pest from a description of the injury, which seldom exceeds five or six words in length, is rarely likely to be successful. Moreover, the instructions for making up the spray fluids are in some cases so brief as to be incomprehensible. Chemical formulæ are used to excess, frequently without any clear indication of the ordinary name of the substance; and inaccuracies and misstatements are inexcusably numerous. What is the fruit-grower to make of the following, with reference to Bordeaux mixture: "The liquid should be thoroughly tested for excess of $CuSo_4$ and $Ca(OH)_2$. If it does not respond to these tests it is unfit for the purpose for which it is intended"? Under the heading of crude petroleum we get the information: "Specific gravity of crude petroleum ranges from 1·049 (A) (ethane) to $0{\cdot}775^{.18°}$ (hexadecane). Boiling-point of ethane as a solid is −86°." Sulphur dioxide has "specific gravity 1. 433680°. 2. 2639(A)." Directions for the use of nicotine sulphate are included, but not for nicotine. Many similar quotations could readily be given. If the author had left out most of the "chemistry" and devoted the space to some elaboration of the spray fluid recipes, the book might have proved useful to the growers and farmers for whom it was written. As it is, it cannot be recommended as helpful. C. T. G.

Refraction of the Eye: including Elementary Physiological Optics. By Dr. Charles Goulden. Pp. xii +276. (London: J. and A. Churchill, 1925.) 10*s.* 6*d.* net.

THE author tells us that this book is the outcome of a series of lectures which he has given at the Moorfields Eye Hospital to candidates for the new Ophthalmic Diploma of the Conjoint Board of England, and that its object is to give an exposition in as elementary a way as possible of the facts upon which the study of the refraction of the eye is based.

We may say at once that the book seems to meet these requirements in an admirable way. The headings to the seven chapters are: optics; the optical constants of the eye; the eye as an optical instrument; errors of refraction; the ophthalmoscope; retinoscopy; muscular anomalies. In this type of book the student is apt to find that the optics and mathematics are not so elementary as the author supposes; he will find, however, in Dr. Goulden's book, that the mathematics required can quite safely be called elementary, and the descriptions are all so particularly lucid that he will find little difficulty in at once grasping the facts. The diagrams, of which there are one hundred and eighty, call for special praise; they are bold and clear and the lettering could not be improved upon.

It is a book that can be highly commended, not only to those whose immediate object is the negotiation of an examination test, but also to many who are well advanced along the road of ophthalmic practice and have not recently polished up such knowledge which is fundamental to the thorough understanding of much of their work. There is a very full index; the type and general get-up are excellent, and we may confidently predict a long life in future editions.

Practical Forestry: from a Workman's Point of View. By A. C. Drummie. Pp. xii + 340. (London: G. Routledge and Sons, Ltd., 1924.) 7*s.* 6*d.* net.

THIS book is written "from a workman's point of view," and is in great measure the outpouring of one discontented with the present conditions of society in England; as such it may be left to the criticism of sociologists. As regards practical forestry, it contains nothing new or even freshly put, the matter being ill-arranged and mixed up with discussions on subjects the connexion of which with forestry is not obvious. The author, for example, "trusts readers will excuse a few remarks on the formation of coal," and proceeds to air his views: "Why is coal put between species of stone or rock? Because the Almighty put it there, and no expert or scientist breathing will ever make the writer believe otherwise." This book is unsuitable for forestry students or woodmen who require accurate description and scientific method in their manuals of instruction. It merits, however, the attention of both landowners and educationists, as its perusal shows how much remains to be done in the school and in the lecture hall to enlighten skilled workmen and artisans concerning the real aims of science.

Medical Hydrology: Outlines for Practitioners and Students. Based upon Lectures given at the University of London. By Dr. R. Fortescue Fox. Pp. viii + 136. (London: J. and A. Churchill, 1924.) 6*s.* net.

THE application of various waters in the prevention and cure of disease is one of the oldest therapeutic measures known to medical science, and in the past has been mainly empirical. In his outlines of medical hydrology, Dr. Fortescue Fox explains briefly the properties and actions of waters and discusses the rationale of treatment by their application. His conclusions are summarised in a series of aphorisms, the dogmatic wording of which is justified in the preface. The book will be useful to practitioners in exercising a choice of spas for the treatment of chronic disease.

Letters to the Editor.

[*The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, nor to correspond with the writers of, rejected manuscripts intended for this or any other part of* NATURE. *No notice is taken of anonymous communications.*]

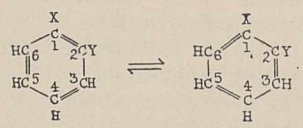
Graphitic Conduction in Conjugated Chains of Carbon Atoms: A Contribution to Armstrong's Theory of Chemical Change.

THE view put forward by Armstrong in 1885, that "chemical action is reversed electrolysis," has been brilliantly vindicated in the field of inorganic chemistry, especially by H. B. Baker's experimental verification of the bold prediction that highly purified water will not determine the explosion of hydrogen and oxygen. In organic chemistry similar evidence in favour of Armstrong's theory has been afforded by the proof that a catalyst is needed even to effect the transfer of an atom of hydrogen from one part of the molecule to another in prototropic compounds such as ethyl acetoacetate or nitrocamphor.

Whilst, however, it is easy to recognise that, in a chemical action between non-electrolytes, the catalyst may play the part of the *electrolyte* in a battery, and that the non-electrolytes themselves may act as *depolarisers* to the ions liberated by electrolysis, it has always been difficult to discover, in reactive systems from which metals in every form are absent, any analogue to the *metallic conductor*. Thus, we can picture the isomeric change of phenylchloroamine into parachloroaniline, $C_6H_5 . NHCl \longrightarrow Cl . C_6H_4 . NH_2$ (in which atoms of hydrogen and chlorine change places under the influence of hydrogen chloride), as depending on a process of electrolysis whereby the catalyst is resolved into hydrogen and chlorine, the *electrolytic hydrogen* being depolarised by the chlorine which it displaces from the side-chain, and the *electrolytic chlorine* by the hydrogen atom which it displaces from the para-position in the ring. This explanation, however, although complete from the chemical point of view, fails to explain the electrical action, since, in the absence of metallic conduction in the aromatic nucleus, it would leave a surplus of two electrons in the para-position and a deficit of two electrons in the side-chain, thus

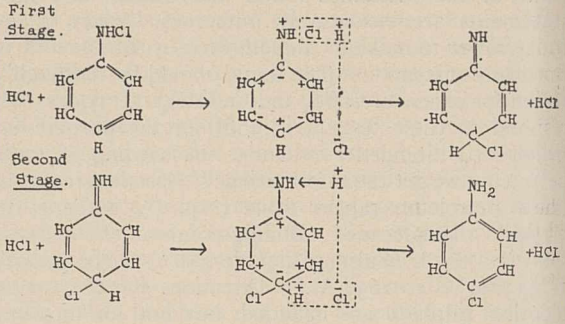
$$C_6H_5 . NHCl \longrightarrow \overset{--}{Cl} . C_6H_4 . \overset{++}{NH_2}.$$

No method of discharging these two poles has, so far as I know, been suggested hitherto; but the fact that chemical changes, and especially isomeric changes, involving distant atoms are so peculiarly characteristic of aromatic compounds, indicates that some special mechanism (producing effects equivalent to metallic conduction) must exist in these systems to render such actions possible. From a purely chemical point of view, Kekulé so long ago as 1872 attributed to the bonds of aromatic compounds a peculiar mobility, which was not found in compounds of other types, when he found it necessary to explain the identity of the 1 : 2 and 1 : 6 derivatives of benzene by a spontaneous interchange of single and double bonds, as in the following scheme:



This interchange of bonds was not regarded, however, as conferring any special electrical properties on the molecules in which it took place. A similar mechanism was used by Lapworth in 1898 to explain the facility with which hydrogen and other radicals can wander between alternate atoms in unsaturated and conjugated compounds. This was attributed to the fact that, at each stage in the migration, the valencies can be adjusted by an interchange of bonds as in the scheme suggested by Kekulé. Thus when the hydrogen and chlorine in phenylchloroamine change places, the *chlorine* was supposed to wander first from the side-chain to the ring, with a simultaneous interchange of the alternate single and double bonds in the intermediate chain of atoms. The original arrangement is, however, restored by a second interchange of single and double bonds, when the *hydrogen* wanders in the reverse direction from the ring to the side-chain.

Lapworth suggested further that the radicals probably migrate *in the form of ions*, but did not put forward any mechanism for the transference of the electric charges left behind by these ions on the aromatic nucleus. If, however, we now add to the electrolytic theory of isomeric change as set out above, the view (based upon the electronic theory of valency) that *at each stage of the action the intermediate double bonds of the conjugated system are ionised*, in the manner suggested in my paper on "The Polarity of Double Bonds" (Jour. Chem. Soc., 1923, 123, 822-831), it will be found that the oscillation of double and single bonds, in the manner postulated by Kekulé and by Lapworth, has supplied the one feature that was needed in order to bring this interpretation into complete harmony with Armstrong's dictum, since the oscillation of bonds makes it possible for electric charges to be handed from one end to the other of a conjugated system, without any simultaneous migration of the intermediate atoms, *i.e. by a process which is analogous to metallic and not to electrolytic conduction*. The isomeric change of phenylchloroamine can therefore be represented as follows:



The chain of molecules of the catalyst through which electrolysis proceeds is here represented by two lines, thus, $\overset{+}{H} \ldots \overset{-}{Cl}$, and, following Lapworth, the transference of the halogen is represented as preceding the transference of hydrogen; but the ionisation of the intermediate system of conjugated double bonds, first in one sense and then in the other, now prevents the accumulation of electric charges at the two poles. It is, therefore, at last possible to formulate a scheme which is just as satisfactory from the electrical as from the chemical point of view, since it reproduces in almost every detail the mechanism of an electric battery, with the possible exception of the precise way in which metallic conduction is effected.

The polarities of the carbon atoms of the ring, as shown in the first stage, are the opposite to those normally developed in derivatives of aniline; and a similar reversal is seen in the polarity of the chlorine, which is usually split off in presence of water as a *positive* ion, *e.g.* in combination with negative hydroxyl

as hypochlorous acid, or (if hydrogen chloride is present as well as water) in combination with a negative chlorine ion as gaseous chlorine. It is, therefore, suggested that the polarities shown above are induced by a cathodic reduction of the chlorine of the chloroamine, accompanied by a simultaneous anodic chlorination of the *para* CH group, and that these conditions are sufficient to produce a reversal of the normal polarities of the system.

In this connexion it is of interest to recall the fact that X-ray analysis has shown that the transparent non-conducting crystals of *diamond* are made up of quadrivalent atoms of carbon linked together tetrahedrally, just like the atoms of a saturated organic compound of the aliphatic series; but in the case of *graphite* it has confirmed the view, already established by chemical methods, that the conducting crystals of this form of carbon are built up from a network of hexagonal rings, of the same type as the conjugated systems of aromatic compounds, in which the carbon-atoms are virtually tervalent. The suggestion that conjugated chains of carbon atoms, united by alternate single and double bonds, can perform the function of a metallic conductor is therefore in harmony with physical as well as with chemical observations. Since, however, the temperature coefficient of conductivity of graphite is positive, whilst that of metals is negative, and since, moreover, we can now assert that the structure of the crystals and probably the mechanism of conduction is quite different in the two cases, it would be wiser to describe the transference of electricity through conjugated chains of carbon atoms as *graphite conduction*, rather than as metallic conduction, and this term has therefore been used at the head of this letter. T. M. LOWRY.

54 Bateman Street, Cambridge.

Influence of Radiation on Ionisation Equilibrium.

IN considering ionisation equilibrium of the type $M \rightleftarrows M^+ + e - U$, the usual method adopted is to write down the entropies of M, M^+, and e from the quantum theory, and then the law of reaction isochore is obtained from the equation $S + S' - s = -U/T$. In this way we obtain the law of ionisation equilibrium

$$\log \frac{x^2}{1-x^2}P = -\frac{U}{2{\cdot}3RT} + \frac{5}{2}\log T - 6{\cdot}5. \quad . \quad (1)$$

The system is regarded as unary (one-component), *i.e.* all the reacting electrons as well as M are derived from the ionisation of M, but when there is excess of electrons, the system is binary and the equilibrium is expressed by the form first given by H. N. Russell, namely,

$$\log \frac{x}{1-x} \cdot \frac{x'}{1+x'}P = -\frac{U}{2{\cdot}3RT} + \frac{5}{2}\log T - 6{\cdot}5. \quad (2)$$

The process is regarded as an abrupt one, M-atoms passing directly under the influence of heat to the M^+-stage, without going through the intervening metastable states. Darwin and Fowler have attempted to include these intervening states by adding to the right-hand side of equation (1) a function $B(T)$. Prof. Russell has pointed out that neither equation (1) nor (2) can be regarded as final, because it fails to take account of the possible influence of radiation and excitation of higher states. We may introduce the matter in the following way. Suppose we have a mass of sodium-vapour in the solar chromosphere. Then the ionisation of sodium atoms is determined not only by the temperature of the chromosphere (say 5000° C), but also by the intensity of photospheric radiation of wave-length λ less than the wave-length of the limit of the P series, passing through these sodium atoms. This radiation has a higher temperature than the local temperature; hence, as was first pointed out by Milne, we have no thermodynamic equilibrium in the solar chromosphere. The excited states are produced under the joint influence of temperature of the chromosphere and of the photospheric radiation passing through the chromosphere. To the same class belongs the absorption experiments of Wood and others, in which a column of sodium or other vapour is acted on by light of much greater intensity than what would be produced at the temperature of the absorbing gas. Here all the excited atoms, or ionised atoms, are produced by light only, and almost none are due to temperature.

The general problem has been thus attacked. In all photochemical reactions the equilibrium is determined by the intensity of light, and in treating these cases from the point of view of the phase rule, Smits expressed the opinion, without however giving his reason, that the ordinary Gibbs formula, $F = C + 2 - P$, must be replaced by $F = C + 3 - P$. We, however, arrive at the same result by assuming that the number of components has increased by one, the photochemically active light being regarded as a new and independent component. In other words, when a normal sodium-atom passes to the $2p$-stage by absorbing the $h\nu$-pulse of D-radiation, then either the excited atom of sodium or the pulse of light may be regarded as a new component, except when the D-light is derived from the effect of temperature prevailing in the gas. In the latter case, the system is a system of one component, as in the corresponding case of free electrons in equation (1).

We thus regard excited sodium-atoms as a compound, in a special sense, of normal sodium-atoms and D-pulse. It has been possible to deduce the equilibrium conditions in such cases by combining the methods given by S. N. Bose (*Zs. f. Physik*, vol. 27, p. 384) and P. Ehrenfest. We give only the final results. If ρ_ν be the density of radiation which is absorbed, and if n_1 and n_2 be the concentration of atoms in the normal and excited states,

$$\frac{n_2}{n_1} = \frac{g_2}{g_1} \cdot \frac{\rho_\nu}{8\pi(h\nu^3/c^3) + \rho_\nu}. \quad . \quad . \quad . \quad . \quad (3)$$

When the light is derived from the temperature of the system we can put

$$\rho_\nu = 8\pi\frac{h\nu^3}{c^3}\,\frac{1}{e^{h\nu/kT} - 1},$$

and we have

$$\frac{n_2}{n_1} = \frac{g_2}{g_1}\, e^{-h\nu/kT}, \quad . \quad . \quad . \quad . \quad . \quad (3a)$$

as is usually obtained from direct application of Maxwell's law, and g_1, g_2 are the weights of the two states. If ρ_ν is very large

$$\frac{n_2}{n_1} = \frac{g_2}{g_1}, \quad . \quad . \quad . \quad . \quad . \quad . \quad (3b)$$

as we can expect from the definition of g_1 and g_2.

In the case of ionisation, let ν be the frequency of ionising radiation (supposed monochromatic). Then the law of ionisation is given by

$$\log \frac{x^2}{1-x^2}P = -\frac{(U - Nh\nu)}{2{\cdot}3RT} + \log\left(\frac{\rho_\nu}{8\pi(h\nu^3/c^3) + \rho_\nu}\right) + \frac{5}{2}\log T - 6{\cdot}5, \quad (4)$$

where $N = R/k$.

If

$$\rho_\nu = \frac{8\pi h\nu^3}{c^3}\,\frac{1}{e^{h\nu/kT} - 1},$$

i.e. radiation is due to the temperature of the system, (4) reduces to

$$\log \frac{x^2}{1-x^2} P = -\frac{U}{2{\cdot}3RT} + \frac{5}{2} \log T - 6{\cdot}5, \qquad (4a)$$

as is obtained directly from thermodynamical theories.

Equation (4) expresses equilibrium in a two-component system, equation (4*a*) in a one-component system.

Of course the ionising power is not limited to one single radiation, nor are all pulses of frequency $\nu > \nu_0$ (ν_0 = convergence frequency of the principal series) equally effective in causing ionisation. But these facts can be taken into consideration in the method used above.

MEGHNAD SAHA.
RAMANI KANTA SWE.

Allahabad, India,
January 21.

The Future of the Meteorological Office.

DR. G. C. SIMPSON writes (NATURE, February 14) that he is sure I should not wish my remarks on the future of the Meteorological Office to be taken as more than my own personal opinion; but on the contrary I believe that my views are shared by a large number of meteorologists. In 1920 the Royal Meteorological Society adopted a resolution regretting that the Meteorological Office had been placed under a Government department, created for another purpose, and urging that the Meteorological Committee should again have control; it was also pointed out that, when in the past changes had been made in the status of the Office, inquiries had been held. On this occasion, since no report has been issued, we must conclude that the transfer of the Meteorological Office to the Air Ministry took place with no public inquiry, and to an outsider it appeared to have been made in a hurried and even arbitrary manner.

The fear that the Meteorological Office may become a mere forecasting department of the Air Ministry, which is what I meant when I said that the future is uncertain, is not dispelled by Dr. Simpson's reference to the "complicated meteorological service for aviation with its thirteen stations on aerodromes." The cares of hourly reports for aviators are not conducive to the development of scientific ideas, and a Government department which has such claims on the Meteorological Office may, under pressure for economy, neglect those aspects of meteorology not directly connected with immediate requirements. The pressure for economy may very likely prove stronger than an advisory committee. It is with misgiving that one notices the giving up of the radio research station at Smallshot Hill (now fortunately taken over by the Radio Research Board), and the transfer of upper air research from Benson, originally chosen for its suitability for *ballons-sondes*, to Kew, where it is in charge of an assistant-superintendent in place of a director of experiments. These researches, of great promise for the study of the atmosphere, were at the time of the change of no immediate utility to the Flying Service. When one considers the real additions to our knowledge of the atmosphere that have come from the freedom and seclusion of Pyrton Hill and Benson, it is almost painful to contemplate the rigorous conditions of a ministry as a nursery of research. Such changes inspire the fear that other researches not directly connected with flying may be dealt with in like manner.

If the Meteorological Office is to be only a forecasting office the chief work of which is for the Flying Service, I agree that it could not be in a better position than at present; but if it is still to be an instrument for the advance of the more purely scientific aspects of meteorology I am forced, despite the larger financial grant, to agree with the resolution of the Royal Meteorological Society. I regret that I am constrained to disagree with Dr. Simpson in this matter, the more so as I am indebted to him for continued help in many meteorological matters ever since he became Director. I sincerely hope that he will be right and that I shall be wrong; but that the future only can decide. In the matter of the present staff of the Meteorological Office I am in absolute agreement with Dr. Simpson, and I used the following words in my address: "The staff of the Office is composed of men of the highest scientific calibre; probably never before in its history has it contained such a galaxy of talent."

C. J. P. CAVE.

Stoner Hill, Petersfield,
February 21.

The Michelson-Morley Experiment.

IN their scheme of their experiment, Michelson and Morley selected a single incident ray, showed how this would divide into a transmitted and a reflected moiety, traced out the path-lengths and found the difference δ. Then, comparing the results in two orientations, they computed the difference $\delta_2 - \delta_1$, which they estimated at $l \times 2\beta^2 = (0{\cdot}00000002)l$ when $\beta = v/c = 10^{-4}$ and the semi-translucent mirror is set at $\theta = 45°$. They applied this computed difference of path-differences to predict a shift of bands in an interference-field; but they did not go into the question how the interference-field (which is undoubtedly observed) is produced.

The only way in which the scheme would work is to assume that the two virtual images of a point on the incident wave-front, formed by the two moieties from the single incident ray, themselves act as two virtual point-sources, capable of producing an interference-field. Also, there must be some definite observation point within the interference-field.

It does not seem to me to be reasonable to assume that the virtual images would act as luminous point-sources, because there would only be one ray to each virtual image, derived from the single incident ray.

I have worked out the precise positions of the final virtual images and the precise single reflected rays passing through these; all as definite functions of c, v and the constants of the apparatus including θ; and I have found a reasonable observation-point, to be reached by the observing eye in a time t.

Then, waiving objections to it for the moment, I have followed up the above implied assumption and calculated out the values of $(\delta_2 - \delta_1)$ for various values of v and various settings θ of the semi-translucent mirror. The results are remarkable and unexpected.

Let the apparatus be ideally constructed; true right angles, equal arms, etc. Let the semi-translucent mirror be set at an exact 45°; and let v be the full $c \times 10^{-4}$. Then (*a*) in both orientations the virtual images, assumed radiant, would be too close together (less than $\frac{1}{4}\lambda$ for yellow light) to produce any interference-field at all; and (*b*) $\delta_2 - \delta_1 = (0{\cdot}0000,0000,0003,0002)l$.

Therefore, on the single-ray scheme, when $\theta = 45°$ and $v = c \times 10^{-4}$, there ought to be no observable effect, not even an interference-field. With θ still at 45°, but $v > c \times 10^{-4}$, as v increases the virtual images are farther apart, and if they acted as virtual point-

sources, an interference-field would begin to be possible until, at a certain large value of v, the breadth of bands would correspond to that actually observed. The immediate neighbourhood of $\theta = 45°$ is a region of extraordinary sensitiveness, in which $(\delta_2 - \delta_1)$ passes twice through a zero value. Very minute changes in θ make very great changes in the value of $(\delta_2 - \delta_1)$.

The numerical data do not lend themselves to any general statement as to the value of v; but they point towards an actual value of v much greater than $c \times 10^{-4}$, however this may be accounted for. So far for the single-ray scheme, with the assumption required by it.

I prefer to deal not with a single incident ray but with an incident plane wave-front, and to study the kind of interference-field necessarily formed where the two reflected moiety-wave-fronts cross one another. Each virtual "image" of the previous working now appears as a point on a virtual plane wave-front, which is at right angles to the corresponding "single reflected ray" of the previous working. The working out is straightforward and unforced; and it again leads to remarkable and unexpected results.

Assuming θ to be an exact 45°, and $l = 1100$ cm. in an apparatus of ideal construction as above; then with yellow light ($\lambda = 0{\cdot}00005892$ cm.) we have in the first orientation a band-breadth of 11784 cm. if $v = c \times 10^{-4}$; 117·84 cm. if $v = c \times 10^{-3}$; 1·1784 cm. if $v = c \times 10^{-2}$; and 0·011784 cm. if $v = c \times 10^{-1}$.

Assuming v to be $c \times 10^{-4}$, we similarly have band-breadths 0·0059 cm. if $\theta = 45° + 1024''$; 0·59 cm. if $\theta = 45° + 10''{\cdot}3$; 3928 cm. if $\theta = 45° + 0''{\cdot}001$; 11784 cm. if $\theta = 45°$; ∞ if $\theta = 45° - 0''{\cdot}0005$; 11784 cm. if $\theta = 45° - 0''{\cdot}001$; 59·22 cm. if $\theta = 45° - 0''{\cdot}103$; 0·59 cm. if $\theta = 45° - 10''{\cdot}3$; 0·0059 cm. if $\theta = 45° - 1036''{\cdot}43$.

Working out and tabulating combinations of various θ's and v's and orientations we might hope, if we had an extraordinarily accurate knowledge of the lengths and angles involved, to be able to reach a conclusion as to the operative value of v from the band-breadths alone. The comparative shift of bands as between two orientations is not helpful in this respect; it depends upon a remainder in decimal places only, where we do not know either l or λ to a sufficient number of working figures. ALFRED DANIELL.

P.S.—By the courtesy of the Editor I have seen Sir Oliver Lodge's comment on the above letter. May I explain further that no bands would or ought to appear unless the instrument be in sufficiently rapid motion *when the semi-translucent mirror is set at an exact* $\theta = 45°$; if at any other angle, there will always be a certain amount of separation of the virtual images which may not be sufficient to produce an interference-field until aided by a sufficient velocity of movement (smaller than in the former case) producing a farther separation of the virtual images. The breadth of bands is a function of θ and v.

THE Michelson-Morley experiment looked for a shift of well-known interference-bands, about the formation of which there was no doubt or controversy. Ordinary wave theory explains the appearance of these bands with ease. Dr. Daniell, however, claims that no bands would or ought to appear unless the instrument was in motion, and that the width of the bands is itself an indication of the rapidity of motion, which is thereby proven to have a high value. This view is so hopelessly unorthodox that it is difficult to regard it with equanimity. Probably he is attending to one single precise ray—whatever that may be—and not to a small portion of a wave-front, with its inevitable slight obliquities. OLIVER LODGE.

The Theory of Hearing.

IN his letter in NATURE of February 14, p. 228, Prof. Scripture directs attention to the valuable work on the theory of hearing done at the New York research laboratories of the American Telephone and Telegraph Company. He refers to the papers of Fletcher, and of Wegel and Lane. The results obtained by these experimenters, in his opinion, completely confute the resonance theory, though he considers that "The simple facts of the accelerated toothed wheel and of portamento speech . . . ought to have been enough to convince any one."

All minds do not function alike, and those propositions which appear self-evident to one are by no means so to another. As an illustration of this truism one finds that Prof. Scripture, though he avails himself readily of the experimental results in question, rejects at once as unworthy of serious consideration the interpretation of those results given by the experimenters themselves. To him it appears self-evident that the results are wholly inconsistent with the resonance theory, though the experimenters state their conclusions in terms of that modification of the resonance theory to which they give the name, the "dynamic theory."

The cochlea as conceived by Wegel and Lane is a highly damped resonating organ giving more or less localised responses to simple tones conveyed to it. The pitch of the tones heard is determined by the maximum points of the disturbances in the basilar membrane. By the term "non-linear" response they imply (as seems to the writer) that the relation at various pitch levels between the intensity of the impulse and the loudness of the tone heard cannot be expressed graphically by a straight line. From this they deduce the generation of combination tones and subjective harmonics in the cochlea. Their theoretical deductions from the results of their experiments are perhaps vitiated by reason of their having left out of consideration the progressive graduation in tension of the basilar fibres by the spiral ligament. In any case there is nothing in them inconsistent with the resonance theory.

Fletcher's results are indeed startling at first sight. The elimination of the fundamental and the first four upper partials from a clarinet tone produced no alteration of the pitch of the tone, the fundamental still appearing as the characteristic pitch. He explains this as being due to the difference tone generated by the remaining partials. To Prof. Scripture this explanation appears so surprising that he can only express his feelings by a note of exclamation. To the writer the suggestion appears rational, and indeed inevitable. Are we to understand that Prof. Scripture does not believe in the existence of the subjective difference tone? Prof. D. C. Miller has analysed the clarinet tone. He states that it may have twenty or more partials, with the seventh to the tenth predominating. This latter group of partials are even stronger than the fundamental, and it is they which are chiefly concerned with giving the characteristic quality to the tone of the instrument. The difference tone of each successive pair of partials would, of course, have the same pitch as the fundamental. Even after the elimination of the five lowest partials, there would still remain fourteen pairs of generators to supply this difference tone. Possibly not all the partials would have sufficient intensity to act as generators, but the four predominating partials probably would. All these experimenters ascribe the generation of the difference tone to the cochlea, and not to the middle ear, as Helmholtz suggested. The writer has advocated the same view elsewhere, though not on the same grounds.

Prof. Scripture states that his deformation theory is capable of explaining these, and indeed all other phenomena of sound perception. Against this claim the writer feels impelled to enter a protest. So far as he is aware, Prof. Scripture has never formulated a theory of hearing. He has stated six "theses" (NATURE, April 26, 1924, p. 605), none of them new, and all of them highly disputable, on which he proposes to construct a theory. Now to the writer a "thesis" means a proposition stated for the purpose of proof or attempted proof. No such proof has been brought forward. To traverse these theses seriatim would be to review the controversies of the last sixty years. The writer is unable to recognise any material points of difference between the theory foreshadowed in the theses and the "pressure pattern" theories of Waller and Ewald, which he has discussed to the best of his ability elsewhere. He has already stated his objections in NATURE (May 31, 1924, p. 781) to some of the chief points of the theses, without eliciting any reply.

On the question of the nature of vowel sounds Prof. Scripture speaks as an authority; but one may be permitted to point out that he is not in agreement with other authorities. Prof. Miller states "The results of the work here described [on the analysis of vowel sounds] are in entire agreement with Helmholtz's theory, and are therefore out of harmony with Scripture's arguments."[1] Later, he speaks of the fundamental tone of the vowel being generated in the larynx.[2] When authorities differ, no single one of them is in a position to impose his own views as absolute.

In any case the simple piano experiments described by Helmholtz and Ellis, and referred to in my former letters (NATURE, May 31, p. 781, and July 19, 1924, p. 87), afford direct evidence that vowel sounds are capable of being analysed by resonators, and consequently weaken any indirect argument against the resonance theory which may be deduced from the supposed nature of vowel sounds.

G. WILKINSON.

Sheffield.

Ecology of Moorland Plants.

IN an article upon this subject in NATURE of November 8, Prof. Priestley discusses the apparently xerophilous nature of the ericoid shoot, and concludes that a plant such as Calluna is better classed as a "xeromorphic mesophyte," which is "able to lose water like a mesophyte because in its natural habitat plenty of water is practically always available." This conclusion is preceded by a brief reference to the recent work of Stocker and Montfort showing that the water of moorland soils is not necessarily toxic to moorland plants, and does not, as Schimper suggested, diminish their effective water absorption. Prof. Priestley accepts their inference from these experimental results and states that the "physiological dryness" of a peaty soil is a "myth," and that therefore "there is not much left of the case for the xerophytic character of Calluna and the ericoid shoot."

I should like to point out that such experiments as those quoted are far from proving the non-xerophilous nature of the ericoid shoot, though they doubtless throw light on the very intriguing question of the water relations of ericoid shoots and leaves. It is true that structural features such as rolled leaves, thick cuticle, and protected stomata do not necessarily indicate xerophily; but the mere capacity for active transpiration during plentiful water absorption certainly does not prove the contrary.

The character common to all xerophytes properly so called is that of resistance to *drought* by any means, water storage, reduction of surface, etc. This has become increasingly clear from numerous observations and experiments of late years (cf. Holtermann, 1907; Fitting, 1911; Macdougall, 1912; Kamerling, 1914; Delf, 1915; the Maximows, 1924). The drought may arise either from atmospheric or from edaphic conditions, and may vary from a brief daily stress, as in the mangroves described by Holtermann (1907), to a prolonged water shortage, as in some typical Cactaceæ, but in either case the xerophyte can endure to lose water (often as much as about half its water content) without harm, whereas in mesophytic plants under the same conditions the leaves are wilted beyond recovery.

How far Calluna and other British Ericaceæ have this drought-resisting capacity has never, so far as I am aware, been tested; but the careful investigations of Thoday (1923) show beyond doubt that Passerina, a South African plant of similar "ericoid" habit and structure, possesses it in a marked degree. The water content of leafy shoots of Passerina gathered in the dry season varied from 25 per cent. to 45 per cent. (averaging about 30 per cent.) of the fresh weight; the water content of specimens taken in the rainy season being usually about 60 per cent. The shoots can thus lose quite half their normal water content without injury.

The case for the xerophily of the ericoid leaves of the British Ericaceæ, though unproven, is thus still highly probable, whatever be the absorptive capacity of the root system when *sufficient* water is available. It is, however, scarcely necessary to point out that, when water is present in the soil, it is not *necessarily* "available" to the plant in the physiological sense of the word, apart from any question of toxicity. "Availability" is estimated as that fraction of the water content of the soil at saturation which can be withdrawn by a well-established rooted plant before wilting can be detected. The wilting point depends upon the constitution of the plant as well as upon other factors. It was shown by Crump in 1911 that when Calluna grows on acidic peat only four-fifths of the soil water is available. That is, if we call the water content of the saturated soil, reckoned per unit of dry weight, 100, signs of wilting will occur in Calluna whenever the remaining soil water has become reduced to 20. In *Erica tetralix* growing in the same soil, the signs of wilting occur when as much as 30 per cent. remains. Such plants may thus have apparently "plenty" of water but actually a water deficit (especially if transpiration is active at the time), which is exactly what would be expected from their structure. It is not known how this condition of incipient wilting in Calluna reacts on the transpiration rate, but measurements of the water content of the plant as it occurs in Nature would probably reveal a much wider variation than is tolerated by plants of a typical mesophytic habit.

Further experimental work is obviously needed before any more definite conclusions are drawn as to the xerophily of the Ericaceæ. Whether their peculiar structure arises as "a natural developmental consequence of the characteristic metabolism of a root system growing in a soil that lacks sufficient aeration," as Prof. Priestley suggests, is an entirely different question which is independent of the possible significance of the final differentiation attained.

E. M. DELF.

Westfield College
(University of London).

[1] "The Science of Musical Sounds," D. C. Miller, p. 217.
[2] *Ibid.* p. 242.

APART from the fact that the conclusion that Calluna is a "xeromorphic mesophyte" should be attributed to Stocker, there is nothing in Dr. Delf's remarks with which I find myself in disagreement, except with regard to their relevance to the point at issue.

Certain features of the structure of moorland plants, inrolled leaves, sunk stomata, thick cuticle, etc., have been explained teleologically as designed to reduce transpiration. Stocker and Montfort show experimentally that the plants transpire very freely in spite of these features. Dr. Delf does not help the teleological argument by pointing out that, even though they lose water freely, the plants may still thrive because of other xerophytic characteristics. Nor are Crump's results relevant to the problem of moorland plants growing in regions of excessive rainfall. The contemplation of these same "xerophytic" structural features in such swampy moorland regions had led to the suggestion that the water might not be "physiologically" available, but Montfort's experimental results show that plants absorb it freely.

It interested me very much to learn, from the presidential address of Prof. F. E. Weiss to the Ecological Society on January 10 last, that these same structural features provide a similar puzzle to the palæobotanist. On one hand, it is argued from such leaf characters that the coal measure forests grew under xerophytic conditions; on the other, from root systems and other features, it is argued that they grew in vast swamps.

J. H. PRIESTLEY.

The Need for a Universal Language.

NOBODY, not even Prof. Kent or Mr. Heron-Allen, really wants Latin as a universal language. Latin is dead; its natural development has ceased and could not possibly meet the growing needs of international thought. Every one recognises that the classical tongue, if it is to satisfy modern needs, must have its grammar simplified and its vocabulary, especially of abstract terms, enlarged. But the features which are to be changed are those which give Latin its peculiar savour and the educational value that some would claim for it. "Modernised Latin" is not Latin at all; it is a hybrid jargon as artificial as Volapuk or Esperanto, as devoid of literary tradition, as incapable of artistic expression, as subject to national and individual vagaries. Of this last defect, of which he accuses Esperanto, Mr. Allen gives a crushing example. Few but English speakers would understand *statio* for railway-station; few but blundering schoolboys would use *quae* as a substantive for *quis*.

The Latinists are crying for the moon. They want as a medium for international communication a "natural" language with at least the possibility of literature. The thing is impossible. To fulfil its object the medium must mean the same thing to all men, however diverse their mentality or experience. The allusiveness that makes literature possible is the fruit of a common life and history; it is the fruit of that nationalist sentiment which it is one of the main purposes of the language to remove. Universal intelligibility and artistic expressiveness can never be combined in a single medium; for art is the trick of meaning rather more than you say. I hope nobody will reply that, if a universal language must always be divorced from literature, we are better without it. That was the fallacy of Ruskin and the cause of most of the sordidness of the Victorian age. An art which seeks to limit utility is doomed; and if literature is set in opposition to scientifically impersonal expression, literature will wither.

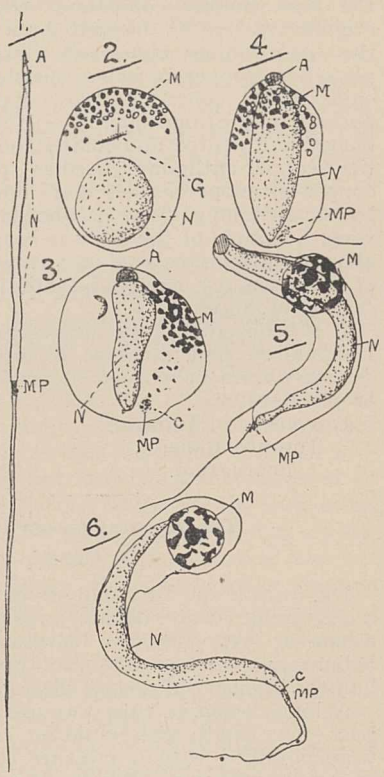
Of course, the view is tenable that modernised "Latin," confessedly artificial and developed from the language of the Romans by some conventional scheme, would be better than its rivals even according to their standards. But it is much more important to have some international language than to have the best conceivable. Esperanto is within the bounds of practical possibility; it has made definite progress; it is supported by an enthusiastic organisation; it is actually being broadcast. For the great mass of the unlearned, anything called Latin is eternally damned by its associations. To some it suggests examinations and school punishments; to others pedantry and obscurantism. It is not a practical possibility, and those who press its claims are merely hampering the cause they profess to serve.

NORMAN R. CAMPBELL.

Spermatogenesis of Peripatus.

THIRTEEN years ago Montgomery, an American cytologist, published a paper in the *Biological Bulletin*, claiming that in Peripatus there was complete rejection of the mitochondria during spermateleosis. This work has been widely quoted as strong evidence against the Meves' mitochondrial idioplasm theory; but Montgomery's investigation has never since been confirmed or denied.

Owing to the good offices of Prof. Gilchrist, of Cape Town, South Africa, and of Canon Forrester, Chaplain of Trinity College, Dublin, six small specimens of the Cape Peripatus arrived alive in Dublin, and I was able to procure some fairly good sections showing spermatogenesis.



At first I believed that Montgomery was correct, but latterly I have modified my views. In Fig. 1, it will be seen that the middle-piece (MP) is very small — probably proportionately smaller than that of any other animal; consequently the problem of its manner of formation is not easy to solve. Figs. 2, 3, 4, and 5 show the mitochondria at M, finally forming a ball, as claimed by Montgomery. This ball is certainly extruded (Fig. 6) as explained by Montgomery, but if one examines a large number of well fixed cells at the stages depicted in Figs. 3, 4, and 5, one will nearly always find a number of fine granules (MP) which eventually form the middle-piece of the tail. I think that these granules are of the nature of mitochondria, because their reactions are similar, and I have got the impression that the middle-piece of the Peripatus sperm is formed from a few of the finer

mitochondria, whereas the main bulk of the coarse granules are rejected. In dealing with such a small cell, and when such small quantities of material are involved, it is not possible to be more explicit. It can be said with certainty that the middle-piece is formed from definite granules which do not appear to be secreted *per se* in the ground cytoplasm.

J. BRONTË GATENBY.

Trinity College, Dublin,
February 10.

Intermetallic Reactions in a Lead-base Bearing Metal.

AN investigation into the influence of pouring temperatures and mould temperatures on the microstructure of a lead-base bearing metal of the following percentage composition (lead, 82·5; antimony, 11·0; tin, 5·5; copper, 1·0) has shown that it is possible for the antimony to unite either with the tin, to form cubes of the compound SnSb, or with the copper, to form needles of the compound Cu_2Sb (Regulus of Venus). Three different pouring temperatures have been employed in this investigation—500° C., 400° C. and 300° C. It has been found that chill castings poured at the higher temperatures—500° C. and 400° C.—contain but slight traces of the tin-antimony compound, whereas chill castings poured at 300° C. contain but few of the purple needles of the copper-antimony compound. If a chill casting containing the tin-antimony compound (that is, one poured originally at 300° C.) be melted and poured at 500° C., the tin-antimony cubes are almost completely replaced by copper-antimony needles. If, however, a chill casting containing the copper-antimony compound (that is, one poured originally at 500° C.) be melted and poured immediately on arrival at 300° C., the copper-antimony needles persist. That the copper-antimony needles may, however, be replaced by tin-antimony cubes is shown by the fact that when a sample of the alloy is heated to 500° C. and allowed to cool slowly to 300° C. before pouring, cubes of tin-antimony compound are found in the chill casting produced.

It is believed that the above observations are new. I should be glad, however, to hear if reactions of a similar nature have been observed in alloys of this or other systems.

O. W. ELLIS.

University of Toronto,
Toronto, Canada,
February 9.

The Auroral Green Line.

(By Cable.)

DR. SHRUM and I have observed in the spectrum of a mixture of air and helium, with the latter in excess, a line at 5577·35±0·15. Mixtures of oxygen and helium give the line enhanced approximately to one-half the intensity of each of the yellow lines of helium.

A long discharge tube was used, surrounded over part of its length with liquid air, and the best results were obtained with a pressure of about five millimetres of mercury. The line was not observable in the spectrum of purified oxygen, hydrogen, nitrogen, or helium. No mixtures of any two of these gases other than oxygen and helium gave this spectral line.

The line is narrow, very sharp, and well defined, and these characteristics, together with its wave-length and the conditions under which it is observable, point to its identity with the auroral green line.

J. C. MCLENNAN.

University of Toronto,
March 10.

Demonstration of the Heating Effect of a Magnetic Field.

To demonstrate the heating effect of a magnetic field, Tyndall revolved between the poles of an electro-magnet a copper-pipe filled with an easy melting fuse: the heat disengaged in it by eddy-currents melts the fuse and the liquid metal is sprayed out in visible globules. To render the heating effect of eddy-currents even more conspicuous, it occurred to me to make the revolving body to glow, and I adopted, after some trials, the following arrangement.

I used as a rotor (Fig. 1) a copper-ball fixed to a

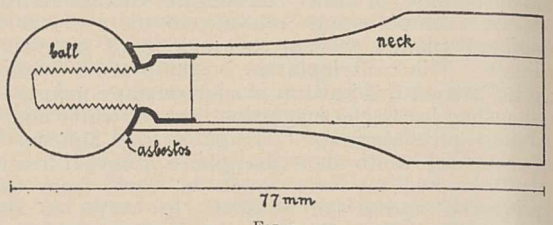


FIG. 1.

copper-neck, and insulated from it by asbestos. The rotor was fixed by the neck to the shaft of an electro-motor—the neck being sufficiently long to allow the ball to be placed in the magnetic field between the poles of the electro-magnet.

Revolving a ball 22 mm. in diameter in a field of $5·7 \times 10^3$ C.G.S. at a rate of $5\frac{1}{3}$ thousand revolutions per minute, the ball begins to glow in a dark room after $1\frac{1}{3}$ minutes, and in a fairly dark room after $1\frac{1}{2}$ minutes.

Omitting the asbestos insulation between the ball and the neck delays the beginning of the glow by about a minute.

HARALD PERLITZ.

Fyysika Instituut, Tartu, Estonia,
February 3.

The Propagation of Radio Waves over the Earth.

THE modified form of the ionic deflexion theory of wave propagation, discussed by Messrs. Nichols and Schelling (NATURE, March 7, vol. 115, p. 334), appears to have been suggested in England and the United States almost simultaneously. That the effect of the earth's magnetic field had to be taken into account in calculating the phase-velocity was pointed out in a paper on "Geophysical Influences on the Transmission of Wireless Waves" read at a joint discussion of the Physical Society of London and the Royal Meteorological Society in November 1924 and already published. The formula for the phase-velocity for transmission along the earth's magnetic field and the calculation of the critical frequencies were there given, and some consequences of these effects have been discussed in a paper communicated to the Cambridge Philosophical Society. Since the earth's magnetic field is strong enough to affect the phase-velocity to a sufficient extent, all the rotatory and double refraction effects familiar in physical optics are appreciable. But probably the most interesting possibility is that the reciprocity relation between two wireless stations may not hold, for the extra forces on the moving electrons due to the earth's magnetic field are, to a certain extent, independent of the direction of propagation of the waves and thus produce relatively different effects for the two directions of transmission.

E. V. APPLETON.

Wheatstone Laboratory,
King's College,
London, March 7.

Biographical Byways.[1]

By Sir ARTHUR SCHUSTER, F.R.S.

II. HENRY WILDE (1833–1919).

HENRY WILDE would have taken a very prominent place among the scientific men of his time had his exceptional abilities not been handicapped by an obstinate and querulous disposition. He had imagination, ingenuity, and considerable experimental skill, but on the other hand he was possessed by vanity, pugnacity, and contempt for anybody else's opinion. In his scientific work he had a good sense of discrimination between the essential and the accidental, but in his personal relations with others, trivial grievances were magnified into serious injuries. Once he complained to the Vice-Chancellor of the University of Manchester that one of his clerks had insulted him. After an expression of regret and on a request for details, it appeared that the clerk, by an oversight, had omitted to put "F.R.S." after his name on a letter.

The threat of legal proceedings was Wilde's favourite method of controversy, and he was reported to have offered his solicitors twice the usual fees on condition that they should never dissuade him from taking legal action. I once asked him why he was so fond of going to law. He replied that it was out of gratitude; and explained that early in his career, while he was the defendant in a law suit, the judge put a question to him which he could not answer, but when he was thinking about the matter on his way home, he was led to the train of thought which resulted in the construction of the first dynamo-electric machine. One would like to know the name of the judge and the exact nature of the question. The law suit referred to was probably that brought by the Universal Private Telegraph Company against Wilde for infringement of patent; the case was decided in his favour.

During the greater part of his scientific life, Wilde was afflicted by a sense of injury, due to what he looked upon as an insufficient recognition of his claim to have invented the dynamo-electric machine. This culminated ultimately in an unfortunate law suit which Wilde brought against Silvanus P. Thompson, who in his well-known treatise had stated that Werner Siemens, in a communication read before the Berlin Academy of Sciences on July 17, 1868, first used the expression to designate all appliances which now pass under the collective name of "Dynamos." Wilde, on the other hand, claimed that the term was first applied to his own machine by Brooke. Thompson was certainly inaccurate in his statement. In the only sentence in which the expression "dynamo-electric" was used by Siemens, it denotes what we now should call "motors." It is a pleasure to add that while Silvanus Thompson won his case both in the first instance and on appeal, he afterwards revised the historical account given in his treatise, recognising Wilde's work in a manner that is not only adequate but even generous.

Disregarding questions of nomenclature, there is no doubt that Wilde's paper, communicated to the Royal Society by Faraday in 1866, was the first important step in the production of electric currents on a scale which opened out the possibility of great industrial applications. Stokes more than once referred, in conversation, to the great impression created at the meeting of the Royal Society when an iron wire, fifteen inches long and one-quarter of an inch in diameter, was raised to white heat and melted.

Mr. Haldane Gee, of the University of Manchester, in his obituary notice of Henry Wilde (Memoirs of the Manchester Lit. and Phil. Soc. vol. 43, No. 5), which contains much interesting information, tells us that Wilde was the son of a working man and was apprenticed to an engineering firm at the age of sixteen. Whatever the social status of his parents may have been, his early surroundings must have been refined and cultured. Though self-taught, his language and style of writing were those of a highly educated man. The extent of his knowledge of the history of science and philosophy, as well as his acquaintance with general literature, were remarkable.

Wilde's contributions to technical science were both numerous and important, but in his later years practical applications interested him mainly in a financial sense.

It will be remembered that when the general public was brought to realise, almost suddenly, that the electric lighting of houses would come into general use, a panic set in among the shareholders of gas companies. Wilde, with clear foresight, chose the moment when the shares were at their lowest, sold his electric works and invested the proceeds in the General Gas and Coke Company. This, together with the royalties he received, secured him a substantial income, and he could thenceforward devote himself to unremunerative work.

Apart from his papers on terrestrial magnetism, to which he devoted much time, and excepting the subject of aviation, Wilde concentrated his attention in later years mainly on questions of a fundamental character. In these, his self-trained mind felt itself free to disregard all authority and to be guided only by his own instincts. Facts were, to him, simply illustrations to be accepted or rejected according as they did or did not fit in with his own views. His firm belief in the evidence of an intelligent design in Nature, which was the basis of his religious and scientific faith, convinced him of the necessary simplicity not only of fundamental laws but also of fundamental facts. Hence his absolute rejection of anything but integer numbers to express physical or chemical relationships. If chemists gave fractional figures for their atomic weights, their measurements, in Wilde's judgment, were necessarily wrong, and if simplicity rules the world, atomic weights were likely to follow the same order as planetary distances, with regard to which he gave unqualified assent to Bode's Law.

For the subject of the annual "Wilde Lecture" of the Manchester Literary and Philosophical Society, which he had endowed and himself delivered in 1902, Wilde selected the old-standing controversy between the followers of Newton and Leibnitz on the measurement of force. To him force meant energy, and he naturally put himself on the side of Leibnitz. The lecture, to which he gave the title, "On the Evolution

[1] Continued from p. 343.

of the Mental Faculties in Relation to some Fundamental Principles of Motion," was a great effort of special pleading, and contains references to passages in the writings of Bacon, Locke, Halley, Copernicus, De Morgan, Descartes, Newton, MacLaurin, Schopenhauer, and more modern writers. As an example of Wilde's style, the second paragraph of the lecture may be quoted :

"It will be universally allowed that if one of the Simiinæ could be taught to enunciate a false proposition, *e.g.*, that space is four dimensional, or that the twentieth century commenced on January 1st, 1900, such a creature would be much more interesting to naturalists, and be more highly valued by collectors, than any of its inarticulate companions of the forest."

Wilde had a grim sense of humour. When some act of the University of Manchester displeased him, one could feel pretty sure that he would give effect to his displeasure by a benefaction to some other scientific institution, generally at Oxford or Paris. He once asked the treasurer and an important member of the council of Owens College to call on him on an important matter. Hopes of a substantial endowment ran high, but they had to hide their disappointment when they found that their presence was only wanted to witness a signature or to assist at some similar trivial function. Wilde's residence stood near the top of a steep lane on Alderley Edge. When bicycling came into fashion several accidents occurred at that point, and Wilde fixed on the usual danger-post a board which carried, beneath the drawing of a skull and cross bones, the legend : "A stretcher may be obtained at the Hurst Cottage below when required." A picture of the post, in its surroundings and with two cyclists inspecting it, appeared in the *Daily Graphic* on September 11, 1900.

Wilde received blows as cheerfully as he dealt them out. It was once my disagreeable task to propose a vote of censure on him while he was sitting in the presidential chair at the Literary and Philosophical Society of Manchester. He had written a letter making unjustifiable accusations against the treasurer of the Society, and some action became necessary. I first gave him an opportunity of withdrawing the letter, but he refused, and when I had made my speech and it came to the vote, Wilde simply said, "I withdraw the letter," and went on with the business of the meeting. "I have had many pinpricks from you, but you have also done me some kind actions," was all the reference he made to the incident after the meeting. Our friendship was never affected by such incidents. He might, at the end of a long discussion during one of his frequent visits to my laboratory, tell me that I was not fit to be a university professor, and a day or two later make amends by sending me a basket of beautiful hot-house grapes.

Wilde's fondness for litigation has already been mentioned. One might almost say that he looked upon it as a form of recreation. I have before me copies of lawyer's letters filling nearly twenty pages, all containing threats of legal action against the Manchester Literary and Philosophical Society, which he truly loved and of which he was a munificent benefactor. It is not necessary to enter into details with regard to them, but his dispute with the Royal Society of Arts deserves to be placed on record, and as an introduction to it I must refer to a previous incident.

Wilde had given a sum of money to the Manchester Society to enable it to award from time to time a gold medal for meritorious work. The Society considered it appropriate to offer the first medal to the donor. Knowing his sensitiveness with regard to the discovery of the dynamo machines, they laid great stress on it in formulating the reasons for the award. Wilde was up in arms : "Your Society," he told the Council, "is a body for the prosecution of pure science. You have nothing to do with technical applications." He refused to accept the medal unless the Council modified their reasons for the award, emphasising his discoveries in pure science. The Council did not see its way to accept Wilde's own formula and the matter proceeded no further. In the following year (1900), the Council of the Royal Society of Arts decided to confer the Albert Medal on Wilde "for the discovery and practical demonstration of the indefinite increase of the magnetic and electric forces from quantities indefinitely small." Wilde again raised objections. The Royal Society of Arts, unlike the Manchester Society, was concerned with industrial applications, while the wording of their award laid stress on a principle rather than on an application. This aroused his suspicion that his claim to the invention of the dynamo and its application to industrial processes was not sufficiently recognised by the Society. In his reply to the letter conveying the award of the medal, Wilde wrote :

"Considering that the principal object of the Society is to give encouragement to Arts, Manufactures, and Commerce, which object is prominently set forth in most of the awards of the Albert Medal hitherto made, the absence of all reference to the industrial applications of my discoveries and inventions in the terms of the award is a notable omission, and, if unrectified, will effectually preclude me from accepting the honour for which I have been designated by the Council."

Three days later Wilde wrote again to suggest a wording which he would consider satisfactory. In the meantime the proposed conferment of the medal in the original terms had been published in the daily press ; this resulted in a lawyer's letter, and the issue of a writ to restrain the Society of Arts from announcing the award in their own journal before some agreement had been arrived at as to the wording. The Society then altered the wording. It added a sentence referring to Wilde's application of his machine to search-lights and the electro-deposition of metals ; and with regard to the dynamo machine, it added that the principle which formed the basis of Wilde's work is "now used in all dynamo machines." This was a fair and adequate statement, but it displeased Wilde more than ever. I think, however—and I saw much of him at that time—that he was more amused than vexed when the Society sent him the medal by post instead of following their usual practice of presenting it at their annual meeting under the presidency of the Prince of Wales.

The incident ended with a letter addressed by Wilde to the Institution of Electrical Engineers, in which, after declaring his dissatisfaction with the terms under

which the medal had been bestowed upon him by the Royal Society of Arts, he proceeds :

"Nevertheless, the action of the Society has invested the Albert Medal of 1900 with a considerable degree of historical interest, and, in response to the recent invitation of the Council of the Institution for gifts of such objects to form a permanent Museum, I enclose herewith the Medal as a contribution to the collection."

The whole correspondence was afterwards published and freely circulated by Wilde.

One of Wilde's peculiarities was his strong objection to have his photograph taken, which was a pity, because he really had a fine and expressive face. "I want to be remembered by my works and not by my physiognomy," he often told me. He added that on one occasion he gave way to the wishes of his wife, but having repented he had the plate destroyed. A copy, however, seems to have been kept by the photographer and was reproduced in his obituary notice. I cannot help regretting this disregard of his wishes.

It remains to mention his extensive benefactions. He gave altogether 10,000*l.* to the Manchester Literary and Philosophical Society and 5500*l.* to the Académie des Sciences of Paris. His endowments, during his life, of scholarships and readerships at Oxford amounted to 3000*l.*, and a contribution of 1500*l.* to the Benevolent Fund of the Institution of Electrical Engineers raised the total of these gifts to 30,000*l.* Yet he died a comparatively poor man. The residuary estate, which was bequeathed to the University of Oxford, after deducting some minor legacies, only amounted to 10,000*l.*

I am afraid that this account dwells a good deal on Wilde's pugnacious peculiarities, but in spite of many acute differences of opinion, I had a very high regard for his straightforward character and attainments. We always remained friends.

The Phylogenetic Classification of Flowering Plants.[1]

By JOHN PARKIN.

THOUGH "the abominable mystery," as Darwin called the problem of the origin of Flowering Plants, is by no means solved, there has been before the botanical world for some years a theory of their origin which is consonant with the derivation of all forms of existing flowers from the Ranalean type. Through Wieland's brilliant elucidation of the structure of the fossil Bennettitean fructification at the beginning of this century, botanists became acquainted for the first time with an unexpected bisexual seed-bearing cone, in which the two kinds of sporophylls bore the same relative position to one another on the axis as they (the stamens and carpels) *invariably* do in the angiospermous hermaphrodite flower; and further, such a cone was subtended by a number of bracts resembling a perianth. The temptation naturally was great to suggest a real bond of affinity between the Flowering Plants and these Cycadean-like Mesozoic plants, the Bennettitales (Cycadeoideæ). A theory was worked out to this effect. Though the peculiar nature of the female part of the cone precludes the direct origin of the Angiosperms from the Bennettitales, the view was put forward that the two groups had diverged from common ancestors with a generalised type of flower-like cone—the *anthostrobilus*, as it was called. These ancestors, it was thought, probably arose from the seed-ferns (Pteridosperms). It was further conjectured that the Angiosperms owed their being to the substitution of insect-pollination (entomophily) for wind-pollination (anemophily), and it has even been hazarded later that this type of cone, the anthostrobilus, may have been evolved in response to insect-visitation. The theory also provided a resting-place for that small puzzling group of Gymnosperms, the Gnetales, and accounts for the peculiar male (morphologically hermaphrodite) "flower" of Welwitschia — the stumbling-block to those botanists who endeavour to derive the Gnetales from the Conifers, a group characterised as a whole by possessing unisexual cones.

The whole speculation, which has rightly or wrongly been termed the "strobilus theory of angiospermous descent," still awaits confirmation or refutation. It has with some botanists lost favour on general grounds. The recent discoveries of palæobotany show that many of the main groups of vascular land plants can be traced right back to Devonian times as independent lines, and Dr. A. H. Church in a recent stimulating memoir has speculated as to the possibility of these main phyla having been even differentiated in the sea independently from one another. Thus it is just possible that the Angiosperms may represent such an independent line, originating from a distinct group of Algæ. Their resemblance then to the Bennettitales would become merely an interesting parallelism. This then may be said to be the chief criticism that can as yet be levelled against the strobilus theory. Dr. Scott, in his latest edition of his "Studies in Fossil Botany," sums up in favour of the theory.[2] If the Angiosperms throughout the ages have been independent of any other vascular group, one wonders why obvious traces of them have never come to light in the Palæozoic rocks. It is difficult to believe that they can, as it were, have stepped out of the sea, fully differentiated, in late Mesozoic times. One of the astonishing facts of palæobotany has been the sudden appearance of Flowering Plants in late Cretaceous times. Dicotyledonous stems are now known, however, from lower Cretaceous rocks, and recently Mr. Hamshaw Thomas has brought to light some remarkable fossil fruits (the Caytoniales), resembling those of Angiosperms, from the middle Jurassic. Possibly then ere long some fresh light may be thrown on the problem.

It is important to recognise that the classification of Angiosperms based on the Ranalean families does not stand or fall with the Bennettitalean theory. If the latter be disproved, the former is only affected to the extent that it has no fossil group upon which to fall back. All modifications of the flower can still as before be derived from a magnolia-like one. The Bennettitalean theory has helped to focus the attention

[1] Continued from p. 342.

[2] 3rd edit. vol. 2, London, 1923, pp. 427-430.

of botanists on the Ranales. Once they have grasped the possibilities of making this group of families a basis upon which to found a new system of classification, they will not be likely to return to the Englerian view of the primitive flower, should the theory have eventually to be discarded. In this way it will have served a useful purpose.

In recent times certain botanists, notably Bessey of America and Hallier of Holland, have endeavoured to supersede Engler's classification by introducing systems of their own based on the Ranalean families. Hallier was perhaps too changeable and prolix to attract the attention he deserved. Bessey was more thorough and logical. The writings of both suggest, however, that their attempts at new systems were more the outcome of book-work than of the actual examination of the living or dried specimens. It is otherwise with Hutchinson. He has not only at hand an unrivalled collection of plants, but also has behind him some twenty years' experience of comparative work in this line. In his first "Contribution" he sets forth his principles,[3] which are essentially those of Bessey, and, we surmise, they will be generally acceptable to those botanists who have ceased to believe in the primitive character of the amentiferous flower. He points out that the evolution of the flower among existing Angiosperms has taken, broadly speaking, either an upwards or downwards course. This in terms of function may be interpreted as either greater adaptation for insect-pollination or a change-over from entomophily to anemophily: and in terms of structure as either great modification and advancement in the shape of the corolla or the complete loss of this organ as no longer required for insect-attraction.

These two evolutionary changes may be considered to have been continually in action in the past and to be still in operation. The older the petalous (entomophilous) group, the more apetalous (wind-pollinated) forms will it have given off. This is exemplified by the fact that the Apetalæ (in the taxonomic sense) have probably been derived as a whole from the Polypetalæ (petals free), a group generally considered earlier and more primitive than the Sympetalæ (petals united). These latter, of mixed polypetalous ancestry and in most cases highly specialised for insect-visitors, present few anemophilous forms. The plantains (Plantaginaceæ) and our native ash (*Fraxinus excelsior*) alone come to one's mind. In the former the corolla has not actually disappeared, though scarcely functional. The latter has naked and often unisexual flowers, though certain species of this genus and the rest of the family (Oleaceæ) have hermaphrodite flowers with a corolla. Perhaps Englerians would have held the flower of the ash as primitive if it had stood alone. As it is, no botanist doubts but that this tree has had petal-bearing entomophilous ancestors.

The paucity of apetalous derivatives from the Sympetalæ may be considered to be due to the shortness of geological time since these forms appeared. At the same time it is well to bear in mind the possibility that the more highly specialised for entomophily a flower becomes, the more difficult it may be for it to change over to anemophily. Hutchinson uses these ideas of progressive and retrogressive evolution as applied to the flower in his proposed scheme for the rearrangement of the earlier dicotyledonous families (Archichlamydeæ). So far as possible, in any circle of affinity, after fixing on the basal group, he first treats of the families showing corolla-advancement, *i.e.* those increasingly adapted for entomophily; and then the families showing corolla-reduction, *i.e.* the degraded forms which through force of circumstances have had to take to anemophily.

A restrictive attitude is adopted by Hutchinson in respect to the value given to the various grades of classification, such as order,[4] family, and genus. The groups thereby become more natural and less unwieldy. An example will illustrate his mode of procedure. Engler's old cohort, Ranales, comprising about 15 families, is split into five orders—the Magnoliales, Anonales, Laurales, Ranales, and Berberidales. His Magnoliales embrace practically the genera contained in the old family, the Magnoliaceæ. This he breaks up into three families—the Magnoliaceæ, Winteraceæ[5] (Drimys and its associates), and Schizandraceæ. The Magnoliaceæ now becomes a very natural family, composed of the genera Magnolia, Michelia and their close allies, together with the Tulip-tree (Liriodendron). The Ranales in the restricted sense contain the Ranunculaceæ (unaltered in composition, but its taxonomy improved upon that occurring in the "Pflanzenfamilien"), the Nymphæaceæ and the Cabombaceæ, formerly a tribe of the foregoing but now raised to family rank.

In some ways we regret the use of Ranales in this restricted sense, though it is in accordance with taxonomic rules. This term and its adjectival form, Ranalean, have been employed in recent times in the wide sense, and especially with respect to the Magnolian flower, hence confusion may be apt to arise in the near future. This, of course, can be avoided by strictly defining one's terms. A new embracing term is now wanted for the families composing, say, the old Ranales together with the Dilleniaceæ. Might not also a substitute be found for the clumsy term, Archichlamydeæ—one in keeping with Sympetalæ, which Hutchinson apparently intends to use instead of Metachlamydeæ? The revival of the Choripetalæ of Eichler is a possible suggestion.

The view that the tree preceded the herb is one that has made headway in recent years. The reverse was perhaps vaguely held last century. Hutchinson makes full use of this new idea, though at the same time prepared to recognise that here and there the opposite may have taken place, namely, herbs giving rise to woody forms. He thinks, for example, that both Clematis and Berberis have had a herbaceous origin. This is distinctly interesting to plant anatomists. It may be expected that the wood of shrubs and trees evolved from herbs will show structural features distinct from the wood of trees which have come from ancestors primitively arboreal in habit. In his proposed rearrangement of the Archichlamydeæ he shows graphically by means of a phylogenetic tree[6] the possibility of

[3] *Kew Bulletin*, 1923, p. 73.

[4] To the older field botanists familiar with the term, *natural order*, now superseded by that of *family*, the use of *order* in this wider sense may be confusing. It was adopted in place of *cohort* by the International Botanical Congress of Vienna, 1905. Presumably there were strong reasons for this change, but they are not apparent to the present writer.

[5] *Kew Bulletin*, 1921, p. 185.

[6] *Kew Bulletin*, 1924, p. 118.

deriving this assemblage of families as two distinct branches—one from the tree Magnoliales and the other from the herbaceous Ranales. Each branch in its ramifications is depicted as giving its quota to the "Apetalæ," the tree-line supplying chiefly the Amentiferæ, and the herb-line such alliances as the peppers, docks, and chenopods. In one case the arborescent habit continues dominant, though herbs eventually arise in the highest forms, *e.g.* in the Papilionaceæ; in the other case herbs prevail, though shrubs and trees occasionally make their appearance. This novel and suggestive idea requires thorough sifting to see how far it may be considered sound. In this connexion, we may here point to his treatment of the family, Saxifragaceæ, as defined in the "Genera Plantarum" and "Pflanzenfamilien." Most will admit that this family, as at present constituted, is cumbersome and unnatural. Hutchinson brings his tree-herb speculation to bear upon it and cleaves it in two. The herbaceous Saxifrages and their allies are placed along with the Crassulaceæ in the order Saxifragales, derived directly from the Ranales (in the strict sense); while the remainder of the old family—the bulk of it, in fact—is split into the Escalloniaceæ, Grossulariaceæ, and Hydrangeaceæ, and as such compose part of his new order, the Cunoniales, derived directly from the arborescent Dilleniales. In consequence, the old family is separated into two sections placed far apart. In this connexion one would like to know how he views the hitherto supposed relationship between Spiræa and Astilbe. If he still recognises it, then no provision appears to be made for it in his scheme. He derives the Rosaceæ, and presumably the genus Spiræa, from the woody Dilleniales; whereas the Saxifragaceæ, as he now limits the family, to which Astilbe should naturally belong, are obtained from the herbaceous Ranales. He partly saves himself in a footnote [7] as follows: "It is probable that some herbaceous *Rosaceæ* have not had a common origin with their ligneous associates." But among the Spiræas are many ligneous forms. These will still require explaining.

In conclusion, it may be thought that the introduction of a new classification of Flowering Plants is a task of too great importance to be entrusted to a single individual. Some may hold it to be a matter for a body of experts. Taxonomy, however, in the past has not progressed in this way. Systems have largely been the result of individual effort. Some have become authoritative, others have not. A single mind tends to keep throughout a consistent value for the various grades of classification. The whole effort will show on completion a symmetry and balance which it otherwise would not possess. This is far from saying that a new system should not be subjected to searching criticism while it is yet in the process of elaboration.

[7] *Kew Bulletin*, 1924, p. 117.

Obituary.

RIGHT HON. SIR CLIFFORD ALLBUTT, K.C.B., F.R.S.

THE sudden and quite unexpected death, after a few minutes' distress, early on the morning of February 22, of Sir Clifford Allbutt, Regius professor of physic at Cambridge since 1892, robs British medicine of its acknowledged leader, who from his scholarly accomplishments recalls Samuel Johnson's description of William Heberden the elder (1710-1801) as "Ultimus Romanorum, the last of the learned physicians." He was indeed remarkable for his wide knowledge not only of modern but of ancient medicine, and for the broad horizon of his conception of the relations of medicine and how its future course should be directed. Thus he was ever insistent on the importance of a sound general educational basis on which medical studies should be engrafted, and he held strongly that universities should provide a liberal education and not lay themselves out for the more utilitarian qualification for the practice of any art or trade, and should not compete with hospital schools. His high standard was shown in a work—the result of many years' research—on "Greek Medicine in Rome" (1921). Since 1888 he had advocated the necessity for the study of comparative medicine and pathology, and happily he lived to see his own University start an Institute for this branch of research, and appropriately he was the first president of the Section of Comparative Medicine at the Royal Society of Medicine.

The wisdom of Allbutt's selection as Regius professor of physic in 1892, and of the departure from the existing custom of appointing a resident physician, has been signally justified. By a similar change at Oxford in 1905, by which Sir (then Dr.) William Osler was transplanted from the Johns Hopkins Hospital, Baltimore, the two older universities were represented by a pair of Regius professors with a world-wide reputation, such as had never before fallen to their lot, for clinical experience and scientific attainments. There were, indeed, some curious coincidences in the lives of these two friends: they became members (1878) and fellows (1883) of the Royal College of Physicians in the same years, gave the Goulstonian Lectures in successive years, and, though these are the almost natural duties of such Regius professors, delivered the Harveian Oration at the College, and edited successful "Systems of Medicine" which have gone through two editions and are destined for a third in the near future by other hands.

Thomas Clifford Allbutt, the son of the Rev. Thomas Allbutt, Vicar of Dewsbury in Yorkshire and friend of Charles Waterton the naturalist, was born on July 20, 1836, and was named Clifford after his godfather, an artist, who married his father's sister, and whose son Edward Clifford painted the portrait of Lady Allbutt hanging in his study at St. Radegund's, Cambridge. Before the Allbutts' time, Patrick Brontë had been one of the curates at Dewsbury, and they knew his famous daughters well; Sir Clifford regarded it as a sacred duty to contradict the impression given in Mrs. Gaskell's Life of Charlotte Brontë that the family were isolated and not in touch with the country people.

Educated at St. Peter's School, York, he went up in 1856 as a classical scholar to Gonville and Caius College, Cambridge, and his name was the only one in thefirst class of the Natural Science Tripos for 1860 with distinc-

tion in chemistry and geology. Entering on November 5, 1858, as University students then usually did, the Medical School of St. George's Hospital, and while a clinical clerk for Dr. H. Bence Jones, F.R.S., secretary of the Royal Institution and an ardent chemist, he became interested in acute aortitis, a subject which afterwards much engaged his attention in connexion with his view of the causation of angina pectoris. With Lockhart Clarke, who was then working at the hospital, he was on friendly terms, and was influenced by his microscopical investigation of the central nervous system; while to J. W. Ogle he ascribed the stimulus to apply the ophthalmoscope to general medicine. He took the M.B., Cambridge, so early as 1860 and the M.D. eight years later. After leaving St. George's he spent some time in Paris following the teaching of the great Trousseau, and about 1862 settled down to practice in Leeds, where he was attached to the Royal Infirmary (1864–1884), and had a most extensive consulting practice in Yorkshire and the North of England, while at the same time carrying out much research and literary work.

In 1889 Allbutt left Leeds for London on accepting a Commissionership in Lunacy, and thus became associated again with Sir James Crichton-Browne, with whom he had worked at the West Riding Asylum; but his stay in London was cut short in 1892 when, after first refusing, he was persuaded to succeed Sir George Paget as Regius professor of physic in the University of Cambridge. For the remaining thirty-two years of his extremely active life, though taking a prominent part in the medical activities of the University and of the country in general, sitting on commissions and numerous committees, he was no longer driven by the exigencies of a busy consulting practice, and this spare time he utilised to the full and to the great advantage of his medical brethren. A notable service in this respect was the editing of a "System of Medicine" (1896–1899) in eight volumes, which was the lineal successor to the "System of Medicine" (1866–1879) in five volumes edited by Sir J. Russell Reynolds. Allbutt's "System" passed into a second edition (1905–1911) in eleven volumes, and received a well-deserved welcome from the medical profession.

It is difficult to summarise Sir Clifford's contributions to medicine, for in addition to his philosophically minded addresses and historical work, he ranged far and wide over the province of medicine. But his name will be more especially connected with certain advances; in the first place, he did much to introduce the now general use of some instrumental methods in medicine; thus in 1868 he introduced the present form of clinical thermometer in place of the long and unwieldy one previously available, and made many observations on the temperature of the body in health and disease, reading a paper in 1873 on the effect of exercise on the bodily temperature to the Royal Society, of which he was elected a fellow in 1880, and was subsequently councillor for two sessions and vice-president.

In 1871 there appeared Allbutt's epoch-making work, "The Use of the Ophthalmoscope in Diseases of the Nervous System and of the Kidneys, and also in certain other General Diseases," wh ch, in addition to giving his own extensive experience, covered the literature, as his published work always did, in an admirably complete manner. It is worth noting that this monograph appeared in the year of the death of the original inventor of the ophthalmoscope—Charles Babbage (1792–1871)—and that its practical use, and of Helmholtz's later modification, in medicine, though suggested by Sir Spencer Wells, is largely due to the advocacy of Allbutt and of Hughlings Jackson. He also did much to bring in the now familiar use of the stomach tube and the sphygmomanometer for the estimation of blood pressure.

Allbutt's most consistent work was on diseases of the cardio-vascular system; in 1868 he gave one, if not the first, of the descriptions of syphilitic disease of the cerebral arteries, buried in the now extinct St. George's Hospital Reports; two years later he insisted on the effects of overwork and strain on the heart and great vessels, published in the same series; since 1895 he had described hyperpiesia or high blood pressure of obscure origin, and insisted that it was not secondary to arterial disease or necessarily to nephritis. Angina pectoris has been variously explained, the most popular view being that it is due to disease of the coronary arteries of the heart, but since 1894 he argued that its real cause is disease of the first part of the aorta. His observations on these various subjects were collected in 1915 in his "Diseases of the Arteries, including Angina Pectoris" (2 volumes, Macmillan), and there is in the press a supplementary work on "Arteriosclerosis: A Summary View." Though he wrote much, he did so with a very critical and careful eye, and, as mentioned in his "Notes on the Composition of Scientific Papers," now in a third edition, he usually made four drafts at least before the manuscript was ready for the printers. The finished charm of his writings aptly corresponded to his personality.

A wide reader, he was most generous in recognising good work by unknown men, and though advanced in years always maintained the mental elasticity of youth. This was, indeed, in keeping with his physical activity; for, like his friend the late Sir Hermann Weber, he was until well on in years a keen Alpine climber; as he wrote to the *Times* a week or so before his death about the proposed alteration, artistically for the worse, of the bridge over the Rotha's "living wave" at Grasmere, he had walked in the Lake District almost every year since he was fourteen, and he rode a bicycle or tricycle last year. With a now somewhat old-fashioned courtesy he was independent, and on occasion spoke out vigorously against what he thought wrong; for example, his castigation of the practices of some gynæcologists in his "Visceral Neuroses" (1884), and more recently his disapproval of psycho-analysis. What would be eagerly sought as honours by many men came by natural right to this beloved physician, and deservedly the list is too long to detail. They were accepted with pleasant expressions of modesty and appreciation, but it could not but be felt that the givers of honorary degrees and medals really honoured themselves by their award. He was made K.C.B. in 1907, and a Privy Councillor in 1920, and could, had he desired it, have been made a peer. English-speaking medicine can well be proud of its great and broad-minded leader.

HUMPHRY ROLLESTON.

THE death is announced from America of Dr. Joseph Clark Hoppin, the well-known classical archæologist. Dr. Hoppin was a graduate of Harvard University, and at one time was professor of classical archæology in Bryn Mawr College, Philadelphia, but relinquished this post to devote himself to research. He was a student at the American School of Archæology at Athens in 1892-3, and took part in the excavations carried on in the Argive Heræum between the years 1892 and 1895. When the work of excavation came to an end, he took charge of the Department of Ceramics and was responsible for the examination and classification of the large quantity of pottery in the Museum at Athens which had been obtained from the Heræum site. His "Handbook of Attic Red-Figured Vases," a standard authority, appeared a few years ago, and his book on "Greek Black Figured Vases" appeared only at the end of last year. He had devoted himself for many years to the formation of a collection of classical antiquities, and it is said that his collection was perhaps the most complete of any in private hands in the United States. The value of his work had been recognised in Great Britain by election to honorary membership of the Society for the Promotion of Hellenic Studies, an honour which he greatly appreciated. According to a sympathetic notice by one of his former colleagues in Athens, which appeared in the *Times* of February 4, he had projected further excavations, at his own expense, shortly before his illness, in the Argive Heræum.

THE *Chemiker Zeitung* records in a recent issue the life and work of Dr. Richard Escales, who died on September 9 at Munich. Dr. Escales' name will be remembered chiefly in connexion with his work on explosives. He was born on July 8, 1863, at Zweibrücken, where his father owned a textile factory. After studying at Würzburg, Munich, Erlangen, and Zurich, he graduated in 1886, and for a while was engaged in his father's business. Somewhat later he returned to Munich in order to undertake the study of explosives in the laboratory of Adolph von Baeyer, and in 1898 he discovered *ammonal*, a high explosive containing aluminium powder, which played a prominent part in the War. He sold the patent rights of this discovery for an inconsiderable sum in Vienna. In 1902 he founded an experimental station for explosives at Munich, where during the War he acted as director of the department of "Minenwerfer." He compiled a seven-volume standard work on explosives and was the founder and publisher of the *Zeitschrift für das gesamte Schiess- und Sprengstoffwesen*.

WE regret to announce the following deaths:

Dr. J. Cleland, F.R.S., from 1877 until 1909 professor of anatomy in the University of Glasgow, and afterwards emeritus professor, on March 5, aged eighty-nine.

Dr. Willet G. Miller, provincial geologist of Ontario, known for his work on the pre-Cambrian and economic geology of Ontario, on February 5, aged fifty-eight.

Dr. J. A. Ormerod, registrar since 1909 of the Royal College of Physicians, and Harveian Orator in 1908 and Lumleian Lecturer in 1914 of the College, on March 5, aged seventy-six.

Sir William Peck, Director of the Edinburgh City Observatory, Calton Hill, on March 7, aged sixty-three.

Dr. J. Ward, professor of mental philosophy and logic in the University of Cambridge since 1897, on March 4, aged eighty-two.

Current Topics and Events.

MUCH satisfaction is felt in scientific circles that the Prince of Wales has consented to occupy the presidential chair of the British Association for the meeting to be held at Oxford next year, either from July 28 to August 4, or from August 4 to August 11. At a meeting of the General Committee of the Association on Friday, March 6, Sir Ernest Rutherford, who was in the chair, reported that the Prince had intimated his willingness to accept the presidency; and he was, therefore, nominated by the Council to the Committee and elected unanimously. The Prince Consort was president of the Association for the meeting held at Aberdeen in 1859, but since then no other member of the Royal Family has filled that office. British science is greatly honoured by the consent of the Prince of Wales to act as president, and his knowledge of the resources and needs of the Empire is so extensive that whatever he may say in his address at the Oxford meeting will have wide influence upon both science and the community.

A PAPER by Sir Arthur Schuster, "On the Life Statistics of Fellows of the Royal Society," has just appeared in the Proceedings, and at last week's meeting of the Society the author himself gave an interesting summary of conclusions. Previously, the subject had been studied by General Strachey, who, in 1892, communicated a paper based on a statistical examination of the average age of the 15 fellows annually elected, their probable duration of life, relationship to an eventual maximum strength of fellowship, and other considerations. The point whether or not a small increase in the number of annual elections is required, in view of the larger scientific output of the country, has been discussed in recent years, but without bringing any change of procedure. The number of fellows of the Society at the beginning of 1848, when new statutes came in force, was 768. In consequence of the restriction in the number annually elected, this total was diminished by more than a hundred in the first ten years; by 1912 the maximum had become 455. Since then the numbers show a steady decline. On January 1, 1923, there were 439 fellows. As regards age at election, Sir Arthur remarks that it is difficult to gauge the effect of the War, but probably it was appreciable. His impression is that the younger men were kept back in their scientific work even when they were not actually in the field; while some of maturer age were substantially assisted in obtaining the fellowship by their War work. The youngest man elected into the Society since 1847 was John Lubbock (afterwards Lord Avebury), who entered at the age of twenty-four.

BROADCASTING in Great Britain on a regular and commercial basis started at Marconi House in London in November 1922. The aerial work of the new 2 LO station has been erected on the roof of the Selfridge building in Oxford Street. There are two towers of the lattice type, the top of each being about 250 feet above the roadway. The towers are entirely self-supporting, no guy wires being used. The aerial is of the two-wire type, the distance between the wires being 15 feet, the wires being connected to an insulator on the roof of the apparatus room by two large cage connectors. The aerials are made of nineteen strands of No. 16 bronze wire and are very heavy. Strings of eight shackle insulators serve to spread and anchor the leading-in cages. The machines installed in the power-house are direct coupled motor generator sets running from the supply mains. Eighteen kilowatts is taken from the mains. Some of this power is needed for the master oscillators which maintain the frequency of the carrier wave perfectly constant. A certain amount of power also is required for the filaments of the many oscillating, modulating and rectifying valves, as well as for the ordinary losses in the machines. The amount of power radiated into space is about three kilowatts, and this is the rating of the station. The greatly increased power and the greater size and height of the aerial will more than double the range of the present 2 LO broadcasting station. The studio, which has always been entirely distinct from the transmitting apparatus, will remain at the B.B.C. headquarters at Savoy Hill, W.C.2. As before, it will be connected with the transmitter by special underground cables. The new station will shortly be in regular operation, for the experiments already made have proved extremely satisfactory. It will be one of the finest broadcasting stations in the world.

SIR ARTHUR KEITH, in his discourse at the Royal Institution on Friday evening, March 6, concerning the rate of man's evolution, described the difficulties in the study of this subject due to the varying stature of men and women among all races of mankind, entailing the measurement of many thousand individuals. In searching the ancient burial-places of England, it is found that the people buried in ancient tombs differed in height in the same manner as at the present time. It may be said that there has been no great change in the stature of the inhabitants of these islands since the close of the Ice Age. The mean average of the modern Englishman of 5 feet 6 inches may be taken as the pivot on which the scales of stature have been balanced for thousands of years. This was shown from a study of fifty ancient skulls from English graves carried out in 1914–15. The evidence obtained from certain fossil remains discovered at Galley Hill in 1888 points to an antiquity of man of no less than 100,000 years. The facts which have been accumulating for some years past on the continent of Europe confirm this conclusion. The discovery of fossil remains made in South Rhodesia in 1921 has disclosed a more primitive human type, but its age has not yet been definitely fixed. By studying the facts which arise from the discoveries made in various parts of the world, anthropologists are able to form an opinion as to the rate at which man has come by the present characters of his body and brain; and the evidence which has been accumulating leads them to the conclusion that the evolution of man has been more rapid than many have hitherto believed.

THE China Indemnity (Application) Bill passed its second reading in the House of Commons on March 3 without a division, and was referred to a standing committee of the House. The debate was interesting and informing, and as such contrasted favourably with the second reading of the Bill brought in last May by the late administration. Mr. McNeill's accurate and well-marshalled knowledge of the facts, and his conciliatory attitude, made an admirable impression not only on the opposition, who objected to the changes in personnel made in the contemplated advisory committee, the places of Mr. Bertrand Russell and Mr. Lowes Dickinson being taken by Prof. Southill and a business representative, but also on the members of his own party, who contended that the best expenditure of the fund would be on railways. Mr. MacDonald in a convincing speech made short work of this contention, while admitting the value of railways in developing national resources. He urged that, in this case, the insufficiency of the sums available; the troubles, complexities, and negotiations which would be involved even in capitalising the fund for such purpose; and the psychological effect on the Chinese of so using the fund rendered such a project impracticable.

IN Mr. McNeill's opinion the phrase in the China Indemnity (Application) Bill "educational or other," which describes the purposes of the fund, should be interpreted to mean that the object must be something in the nature of education, or, at all events, it must be something which is not absolutely divergent from the main idea. Since, however, notwithstanding this opinion, divergent purposes were pressed on the House, this point, with Mr. McNeill's concurrence, will be decided in the standing committee. It may be hoped, therefore, that Mr. Somerville's amendment, "educational, medical or other similar purposes," will be accepted. These words evidently meet the views which Mr. McNeill expressed, and their adoption would relieve the advisory committee of an invidious task. As to the constitution of this committee, a present member of it characterised it as "derisory" from a Chinese point of view. Though its object is educational, the Board of Education has no concern whatever in its membership; no medical man has a seat; and, if trade interests are not to be pressed, the inclusion of a Board of Trade official seems undesirable. Besides that, the other members are so occupied with public or private work that the time and attention they would be able to devote to this important work must be limited, and, considering the opportunity of national service which the fund offers, may be exiguous.

THE report of the executive committee of the Empire Cotton Growing Corporation, submitted at the

meeting of the administrative council held on February 25, has underlying it a tone of expectation of a great increase in cotton production in the tropical and subtropical colonies. Indeed, many signs point in this direction, and it is a matter of vital importance to the British Empire to grow as much of its own cotton as possible. Mr. Milligan, formerly Inspector-General of Agriculture in India, and now in charge of the work of the Corporation in South Africa, gives an interesting account of this. There will be fifteen men working at cotton problems this year, as against four in 1924. Rhodesia, where the greatest possible interest is being taken in cotton, has so rapidly expanded its area under this crop that difficulties are arising in respect to ginnery accommodation. Nigeria is about to start Government farms for the supply of seed. The Corporation has appointed a cotton breeder to work in the Sudan. Nyasaland has obtained a reduction in railway rates upon maize, which will form the necessary secondary crop for a rotation; and so on. The evidence of the great interest now being taken in Empire cotton, and of the expansion of its cultivation, is growing more marked every day.

COL. PURVES, the Engineer-in-Chief of the Post Office, read an interesting paper to the Institution of Electrical Engineers on the "Post Office and Automatic Telephony" on March 5. A general history was given of the development of automatic exchanges. The system actually adopted by the Post Office is a development of the Strowger system, now called the "Director System." This system was devised by the Automatic Telephone Manufacturing Co. of Chicago, and, on the whole, it was considered better than the other systems. The electric power required for an exchange of 10,000 lines is provided by two 50-volt batteries each of 10,000 ampere-hour capacity. The requisite current at peak load will exceed 2500 amperes. When a subscriber has finished dialling his instrument he hears immediately the "ringing tone" which tells him that the required subscriber is being rung up, or the "busy tone" which tells him that he is engaged. The extreme complexity of modern automatic circuits and equipment is illustrated by the fact that a single automatic switching unit of 10,000 lines comprises no less than 5 million contacts. Any one subscriber in an exchange of this size can obtain connexion with any other subscriber by 240,000 different linkages. To reach all the subscribers in his unit he has 2400 million different linkages at his disposal. When we consider the large number of other exchanges he can get in contact with, the number of linkages is enormously increased. Graduated courses of instruction are now being given to the skilled workmen who will maintain the exchanges in working order. The inspectors and engineers who will have to be responsible for the mechanism and the efficiency of the service are also being specially trained.

COL. PURVES, in his paper referred to above, points out that the modern automatic calling dial is a remarkably simple piece of apparatus considering the immense complexity of the machine which it controls. This simplicity is the result of a long period of evolution since some one in the Automatic Electric Co. first had the happy thought of making a rotating disc with finger holes for the purpose of sending the trains of impulses required for the Strowger automatic system. The master patent secured a monopoly for this device from 1898 to 1912. During this time a great amount of ingenuity was expended in inventing other signalling devices which would not infringe this patent. During all this period an old and forgotten telegraph device, invented by Cooke and Wheatstone not later than 1839, anticipated in all essential respects the terms of the master patent. It was found during a clearing up of an old storeroom of the General Post Office in 1913, when the master patent had just expired. It anticipated all the explicit claims of this patent. It is curious that a patent controlling such large commercial interests, and considered unassailable for fourteen years, should have been so completely anticipated by the earliest pioneers of telegraphy.

D. N. PRIANISHNIKOV, the eminent Russian professor of agriculture, whose thirtieth anniversary of his scientific work is being celebrated in Moscow during this month, was born in 1865 in Kiachta, S.E. Siberia. After completing his course at the school at Irkutsk he entered the University of Moscow, but soon left it to take up studies in the Agricultural Academy at Petrovskoje, near Moscow; in 1888 he passed his final examinations, and was offered a post-graduate scholarship. In 1891 he was sent abroad to study the agricultural chemistry and physiology of plants, mainly in Germany, with Prof. Schulze. In 1891 he was appointed lecturer, and in 1895 professor of agriculture in the Agricultural Academy of Petrovskoje, a post which he still holds, so that through his laboratories passed many hundreds of Russian agricultural specialists. In his scientific work Prof. Prianishnikov approaches the views and ideas of Bussengo, while his thorough training in the physiology of plants by one of the ablest botanists of the last century, K. Timirjazev, and in chemistry by G. Gustavson, enabled him to elucidate a long series of most complicated problems, mainly concerning fertilisers and manures and their physiological effects. His dissertation for the doctor's degree, on the dissimilation of proteins in connexion with breathing and assimilation of carbon dioxide, which appeared in 1899, has been followed by numerous other works, about 200 in number, mainly in Russian and German agricultural periodicals. Two of his books, a course of agriculture, and a handbook on fertilisers and manures, are amongst the best of their kind, the latter having been translated into Polish and German. The influence of Prof. Prianishnikov's works and of his teaching on the progress, especially of research work, in Russian agriculture cannot be overestimated. Hundreds of his former pupils, with whom he always keeps in touch, have been and still are working in different parts of Russia, developing his ideas and accumulating scientific data. For an agricultural country like Russia, scientific workers

of Prof. Prianishnikov's type must be (if not always are) considered amongst the principal factors in the progress of the country.

IN the official report, issued by the Textile Institute, of Proceedings of the first Empire Textile Conference (held at the British Empire Exhibition at Wembley in Whit-week 1924) accounts are given by the Directors of the Cotton, Woollen, and Linen Research Associations of the present position of scientific research in textiles and of the advantages that must necessarily follow from persistent application of scientific method to problems of the trade. Numerous examples are given of spinning, weaving, and finishing problems which are now being investigated by the research associations, and attention is directed to the unlimited field for further research on matters the solution of which will be of the utmost national and Imperial importance from the points of view of the grower of the raw material, the manufacturer and the user. In addition, the first part of the report contains sixteen papers dealing with exceedingly wide interests, including Empire supplies and consumption of wool and cotton, the possibilities of the British silk trade and the statistics of the textile export trade. It is pointed out that the rapid increase in wool consumption during the last twenty years has been accompanied by an enormous decline in wool production, and an appeal is made to our great overseas Dominions to rectify this lack of proportion. The vast economic importance of the cotton trade is referred to, and it is emphasised that as this is the largest manufacturing industry in Great Britain, the importance of increased Empire production of raw cotton, upon which the stability of this great industry must ultimately depend, is a matter of grave concern if the trade is to retain its pre-eminent position in the world's markets. The decline of the British silk trade in the last fifty years has been considerable, although the Empire demand is sufficient to warrant a four-fold expansion of British trade in this material. The second part of the report contains eleven scientific papers on the physical and physico-chemical problems relating to textile fibres, and a discussion thereon (held in conjunction with the Faraday Society), an account of which appeared in NATURE for July 5, 1924, p. 27.

THE Faraday Medal of the Institution of Electrical Engineers will be presented to Sir J. J. Thomson at the ordinary meeting of the Institution to be held on Thursday, March 19, at 6 P.M. The presentation will precede the reading of Mr. S. Evershed's paper on "Permanent Magnets in Theory and Practice."

THE Society of Glass Technology has established a small Research Fund for the purpose of promoting research in subjects related to glass technology. Grants from this fund will be made to assist in conducting specified items of research approved by the Council of the Society. Applications should be addressed to the Secretary, Society of Glass Technology, Darnall Road, Sheffield.

THE annual prize of the American Association for the Advancement of Science for the 1924 meeting at Washington has been divided and awarded as two prizes of five hundred dollars each, to Dr. L. R. Cleveland, of the Johns Hopkins School of Hygiene and Public Health, for his work on the physiology of termites and their parasites, and to Dr. Edwin P. Hubble, of the Mount Wilson Solar Observatory, for his work on the nebulæ.

THE Hon. W. G. A. Ormsby-Gore, M.P., Under-Secretary of State for the Colonies; Sir Frank Heath, Secretary of the Department of Scientific and Industrial Research; and Sir Richard Gregory will be the principal guests at the annual dinner of the National Union of Scientific Workers to be held at the Adelaide Gallery (Gatti's Restaurant), King William Street, Charing Cross, on Thursday, March 19. The president of the Union, Prof. G. H. Hardy, will be in the chair.

THE Fison Memorial Lectures, which have been established in memory of the late Dr. A. H. Fison, lecturer in physics at Guy's Hospital Medical School, and Secretary of the Gilchrist Educational Trust, will be inaugurated on Thursday, May 7, when the first lecture will be given by Sir J. J. Thomson, Master of Trinity College, Cambridge, who will take as his subject, "The Structure of Light." The Right Hon. The Earl of Balfour will preside at the meeting.

THE Huxley Medal of the Royal Anthropological Institute has been awarded to Sir William Ridgeway, Disney professor of archæology in the University of Cambridge, in recognition of his services to anthropological science, particularly in connexion with the study of the archæology of the Mediterranean area. Sir William Ridgeway, who was president of the Royal Anthropological Institute in 1908 and 1909, will deliver the Huxley Memorial Lecture in 1926. The Huxley Memorial Lecture for 1925 will be delivered by Sir Arthur J. Evans in November next.

LIEUT.-GENERAL SIR WILLIAM B. LEISHMAN, Director-General, Army Medical Service, Hon. Physician to the King; Sir Richard Lodge, professor of history, University of Edinburgh; and Mr. William Rothenstein, Principal of the Royal College of Art, South Kensington, have been elected members of the Athenæum under the provisions of Rule II. of the Club, which empowers the annual election by the Committee of a certain number of persons of distinguished eminence in science, literature, the arts, or for public service.

THE spring conversazione of the staff of the Natural History Museum was held in the Board Room on March 4, and attracted the usual large attendance of members and visitors. On this occasion most of the exhibits were selected to illustrate desert conditions and the effect of desiccation. They included fulgurites (lightning tubes), desert roses, and etched pebbles (the cause of the peculiar markings of which still remains an unsolved problem); Coleoptera, Diptera, and Lepidoptera, illustrating the development of desert colour; hares, rats, mongooses, and birds, showing the effect of desert environment; lizards illustrating modifications in the scales, eyes,

and feet; and desert plants showing the development of spines and prickly leaves as a protection against thirsty and hungry animals. Among the exhibits was a remarkable specimen of *Helix desotorum*, the common desert snail of Egypt, which was fixed on a tablet in the Museum in March 1846, and was found in March 1850 to be still alive after four years in a Museum case without food or moisture. The snail became torpid in October 1851, and was found to be dead in May 1852. Among the general exhibits may be mentioned specimens illustrating a recent study of the occurrence of Gongylonema in Italy by Dr. L. W. Sambon and Dr. H. A. Baylis.

A JUNIOR scientific assistant is required by the Admiralty for research work. Candidates must possess an honours degree in physics or its equivalent, have a good knowledge of general physics, and have had some experience in research. Applications should be sent to the Secretary of the Admiralty (C.E.), Whitehall, S.W.1.

THE Experimental Department of H.M. Signal School, Portsmouth, invites application for a junior scientific assistantship from holders of an honours degree in physics or its equivalent. Applications should be sent, with particulars of qualifications and with testimonials, to the Secretary of the Admiralty (C.E.), Whitehall, S.W.1, not later than April 7.

WE have received from the Castner-Kellner Alkali Co., Ltd., a pamphlet on sodium peroxide. This compound was discovered by Gay Lussac and Thenard about 1810, but it was not until 1891 that it was manufactured on a large scale. The properties are described and the method of using the substance for bleaching purposes is set out in some detail. Useful tables of acid densities, etc., are also included in the booklet.

AN interesting tour in the Dordogne and Vézère Valleys during the Easter vacation (April 9-25) has been organised by Prof. Patrick Geddes. It will include visits to the principal prehistoric sites and caves in the neighbourhood of Les Eyziès under the guidance of Dr. Peyrony, the curator of the Musée Archéologique, who will also conduct the party around, and demonstrate, the collections in the museum. Dr. Peyrony has recently published an account of the investigations carried out by himself in company with L'Abbé Breuil and Dr. Capitan at Les Combarelles, and this opportunity of visiting the classical sites of palæolithic art and culture under his guidance should appeal to all who are interested in prehistoric archæology. The second part of the tour will be devoted to a series of excursions for the purpose of the study of the geography and history of the most attractive portions of the Dordogne Valley, Domme being taken as the centre. These excursions will be conducted by M. Paul Réclus. Particulars may be obtained from Miss M. M. Barker, 152 Abbey House, Victoria, S.W.1.

THE Women's Electrical Association has been formed with the immediate object of promoting the wider use of electricity in the service of women, and a large and representative council has been formed to guide its activities. Lectures and demonstrations of the applications of electricity are in hand, and the study of electrical applications in universities, colleges, and schools, particularly in relation to domestic subjects, is to be promoted. It is also proposed to institute a junior section which will be more especially concerned with girls' schools and colleges. Particulars can be obtained from the director of the Association, Miss C. Haslett, 26 George Street, Hanover Square, W.1.

WE have received a copy of the first issue of a new Italian monthly review entitled *Leonardo*, devoted to Italian culture in all its varied aspects, and published in Rome under the auspices of the Leonardo Trust and the editorship of Giuseppe Prezzolini. The review is illustrated, and is to be conducted apart from political influence and from the influence either of any literary or philosophical school, or of any firm of publishers. Its aims are not merely bibliographical, but comprise the study of cultural activities of all forms: scholastic, journalistic, theatrical, and even cinematographical. This first number contains, among other contributions, articles on the second International Book Fair, to be opened in Florence at the end of April, on the work of several Italian authors, and on British literature relating to Italian matters, together with a number of reviews of Italian books dealing with art, philosophy, hygiene, the literature of Italy and other countries, linguistics, medicine, pedagogy, geography, religion, social and political sciences, history, and the theatre. It is well produced, and should command a wide circulation, both in Italy and elsewhere.

THE Cambridge University Press announces for early publication vol. i. of a new edition of "Principia Mathematica," by Prof. A. N. Whitehead and the Hon. Bertrand Russell. There will be three volumes in all.

AN interesting catalogue (No. 467) of some 1300 second-hand books on anthropology, folk-lore, archæology, and sociology has just been issued by Mr. F. Edwards, 83 High Street, Marylebone, W.1. Copies can be obtained upon application.

WE learn that Messrs. J. W. Atha and Co., who are the distributors for Messrs. Carl Zeiss, Jena, have now transferred their business to larger and better equipped premises at Winsley House, Wells Street, Oxford Street, London, W.1.

THE Schlomann-Oldenbourg Illustrated Technical Dictionaries in English, French, German, Italian, Russian, and Spanish, are familiar works. A British office has now been opened with Mr. H. I. Lewenz as editor and manager, and he will be responsible for the English terms and phrases contained in the dictionaries. Volumes are to be issued shortly on weaving and woven materials, on mining, agricultural machinery, chemistry, gas engineering, etc. The work is issued and stocked by Messrs. Lewenz and Wilkinson, Ltd., 25 Victoria Street, Westminster, S.W.1.

Research Items.

FURTHER EXCAVATIONS AT SOLUTRÉ.—*La Nature*, February 14, contains an illustrated report of the excavations at the prehistoric station of Crot-du-Charnier, Solutré, in 1924, which was presented to the Paris Academy of Sciences by MM. Depéret, Arcelin and Mayet on December 15 last. The trench in which three skeletons were found in 1923 was carried farther to the west and revealed the continuation of the thick, undisturbed bed of horse-bone magma. Immediately beneath this was found a fourth skeleton, a male, of Aurignacian age, as was revealed by the associated implements — gravers, flakes, scrapers, etc. Three stone slabs were placed on a level with the head. The legs of this skeleton had been destroyed by the excavations of the Abbé Ducrost in 1875. A fifth skeleton was that of a young woman which lay, not beneath, but actually in the horse-bone bed, which showed no sign of disturbance. The skeleton had clearly been buried there during the period of formation of the bone-bed, which is nothing but the kitchen refuse heap of the Aurignacian hunters, who fed on the horse. This skeleton had no sepulchral slab. A detailed description of the skeletons by Dr. Mayet is in course of preparation. A preliminary report shows that the fourth skeleton is a male of about 40 years of age, in height 1·67 m. to 1·70 m., dolichocephalic, but with a tendency to brachycephaly—index 77·89. The cranium is relatively high, the face broad but low, with prominent cheek bones, orbits quadrangular, low and elongated with an index of 69·7. The fifth skeleton is a female of about 30 years, in height the same as skeleton No. 1—1·53 m. to 1·55 m.—cephalic index 83·24, face broad and very low, orbits oblique, oval and mesoseme—index 86·5. In general it shows a striking resemblance to the female skeleton No. 1 found in 1923. The suggestion that the women belong to a different ethnic group is plausible, although it is recognised that in many ethnic groups the men are big and the women small.

BRONZE IN CHINA.—M. A. Vayson de Pradenne, in collaboration with M. G. Chesneau, Director of the École Nationale Supérieure des Mines, has published in *L'Anthropologie*, T. 34, 6, a metallurgical and archæological study of bronze weapons from China, with special reference to two swords and a halberd which are tentatively assigned to the end of the Bronze Age. The interest of the three weapons in question lies in the fact that not only are they in an excellent state of preservation, but also that they had been tinned. The tinning had taken place after the smoothing and polishing process which followed the casting. An analysis of the bronze shows: tin 16·44, copper 82·32, lead 0·15, iron 0·43, zinc 0·20, and of manganese, nickel, and arsenic, traces only. The superficial area shows tin only, with traces of copper at the point of contact with the bronze. The bronze is therefore of a composition which gives the maximum hardness without being brittle, the limit for a weapon which was to receive blows without risk of fracture being put at 16-17 per cent. of tin. It is suggested that the tinning was a device to obtain greater hardness without increasing the brittleness of the weapon. The superposition of tin on the bronze has produced a thin hard layer which offers greater resistance than the inner metal to a steel drill. It is clear that the weapons have been ground and polished after tinning so that the layer of harder metal forms the cutting edge.

CLIMATE AND PLANT DISTRIBUTION IN THE LIGHT OF THE FOSSIL RECORD.—In the Masters Lectures published in the Journal of the Royal Horticultural Society, vol. 50, part i., January 1925, Prof. A. C. Seward gives a delightful account of Arctic vegetation as studied by him in his Greenland visit of 1921. The keynote of his lectures is to be found in a vivid passage in the first paragraph, in which he speaks of the experience of collecting a fossil frond of a Gleichenia, similar to the living frond he had seen in a Malayan forest, from the rocks below a flower-sprinkled Greenland heath. Prof. Seward attempts to answer the question whether the fossil record of these Arctic latitudes, as symbolised by this Gleichenia, necessitates the assumption that in pre-glacial times tropical climatic conditions prevailed in these northern climes. He points out that the wide range of climate and altitude covered to-day by Gleichenia suggests the need for caution in drawing such a conclusion. His analysis of the modern Arctic flora, with its dominant herbaceous perennial type, certainly contrasts strongly with the arboreal character of many fossil remains from these latitudes, but Prof. Seward makes it clear that modern investigation has not yet justified the assumption that structure has been directly and profoundly modified by Arctic conditions. His cautious inference appears to be that the contrast of living and extinct floras of Arctic regions like Greenland justifies the assumption of considerable climatic change such as would accompany the changes in the distribution of land and water, of land elevation and water circulation, that might be expected in vast periods of time, but do not involve the assumption of changes in the position of the earth's axis of a nature that the astronomers are not ready to concede.

DYING-BACK OF ROSE SHOOTS.—In the Journal of the Royal Horticultural Society, vol. 50, part i., January 1925, W. J. Dowson describes very fully a disease met with on rambler roses in the Society's garden at Wisley. The organism responsible for the dying-back of the rose shoots proved to be an ascomycete with small perithecia and was identified as *Gnomonia Rubi*, Rehm. After culture of the isolated organism, successful inoculation experiments were carried out, and no doubt remains that this organism was responsible for the disease. Other occasional records of this parasite, together with field observation, suggest that whilst the fungus may be widely distributed (on brambles and roses) it is relatively rare and seldom does much damage to roses, in this case probably entering the plants through buds previously killed by frost.

SOME INDIAN EARTHWORMS.—Dr. J. Stephenson (Records Ind. Mus., 26, pp. 317-365, 3 pls., 1924) gives an account of some Indian earthworms and describes two new genera of Ocnerodrilinæ. Only a single endemic species—*Gordiodrilus travancorensis*—of this family has until recently been known in India. Michaelsen described a second—*Curgia narayani*—in 1921, and now Stephenson describes two new genera, Malabaria and Aphanascus, which belong to this family. Malabaria is probably the immediate ancestor of Aphanascus, and the latter very possibly leads on to Curgia. The discovery of these worms strengthens the evidence of a faunistic relationship between India and E. Africa. The author refers to the interest of the occurrence of the two new genera in the same place (South Malabar) and surmises that the origin of the younger genus Aphanascus has taken place here and at no remote period, and yet the morphological differences between the two genera are not inconsiderable. It would appear that large morphological changes—sufficient to give rise to new

genera—" may come about in no great length of time, and that evolution may proceed, at times, with large strides and at a rapid pace." The paper forms an interesting addition to the author's analysis of the phylogeny of Indian Megascolecidæ.

THE MEDUSÆ OF THE MEDITERRANEAN AND ADJACENT SEAS.—In the reports on the Danish Oceanographical Expeditions, 1908-10, to the Mediterranean and adjacent seas (vol. 2, pp. 67, 1924) Dr. P. L. Kramp describes the collection of medusæ—Anthomedusæ 8 species, Leptomedusæ 6, Trachymedusæ 11, Narcomedusæ 4, and Scyphomedusæ 6, and gives figures of the species and maps showing the distribution of many of them. No new species was secured, but the collections have increased our knowledge of the range of distribution. Of the 27 species collected in the Mediterranean, only one was a new record for that sea, but several species hitherto known from but a few localities have been found to be widely distributed, and 3 species hitherto known only from the Mediterranean have been found to occur in Cadiz Bay. Of the 17 species found by the *Thor* in the Atlantic, between the south coast of Ireland and the north coast of Morocco, seven—chiefly deep-sea forms—do not enter the Mediterranean. Dr. Kramp discusses in some detail the connexion between the distribution of the species and the hydrographical conditions.

PHILIPPINE EARTHQUAKES.—The Rev. M. Saderra Masò, who has studied the Philippine earthquakes for so many years, gives a catalogue of 52 earthquakes of intensities 7 to 10 (Rossi-Forel scale) during the years 1901-22 (Weather Bureau, Manila Central Observatory, for September 1922). Of these, 31 were strong enough to damage buildings. Most of them originated under the neighbouring parts of the China Sea, the Celebes Sea, and the Pacific; those taking place beneath land or the inter-island seas being of slighter intensity. In all cases, the areas of destruction were those occupied by alluvial deposits. As a rule, only poorly-built houses were injured, with one curious exception. During an earthquake in 1907, a modern addition to the front of an old building was entirely demolished, while the original portion suffered no injury.

STRUCTURE OF A DENDROID GRAPTOLITE.—The structure and development of an early form of Dictyonema from the Upper Cambrian of Shropshire has been studied by O. M. B. Bulman (*Geol. Mag.*, 1925, p. 50). The work was facilitated by using a method for separating the fossil from the matrix in which it was embedded. It is found that this species of Dictyonema approaches the true graptolites more nearly than do the later forms of the genus, since it shows no true common canal and no spiral arrangement of the hydrothecæ, both of which characters are present in Silurian species. This suggests that the dendroid graptolites have been derived from the true graptolites. The hydrothecæ are of two kinds; the smaller (called bithecæ) are budded off from the sides of the larger, and it is suggested that they lodged polyps of the nature of dactylozoids. The hollow transverse bars (dissepiments) joining the stipes are formed as outgrowths from the bithecæ.

NEPHELINE-SYENITES IN RAJPUTANA.—In the Records of the Geological Survey of India (vol. 56, part 2, pp. 179-197, plates 2-12, 1924) Dr. A. M. Heron gives an account of the nepheline- and sodalite-bearing syenites of Kishengarh in Rajputana. These are of unusual interest on account of the occurrence, in some of their pegmatitic forms, of a peculiar sodalite which, when broken, is pale crimson on the freshly-opened surfaces, but rapidly turns to pale grey on exposure to bright daylight. The occurrence of this strange phenomenon was noticed first about twenty years ago (Rec. Geol. Surv. Ind., 31, 43, 1904; 32, 158, 1905), but its cause has never been worked out. During the visit of the British Association to Canada last year a similar peculiarity was noticed by members of a geological excursion party whilst examining the nepheline-syenite area in the Bancroft area, Ontario; and the change of colour, similarly from crimson to pale grey, is shown in this instance by white translucent sodalite. In the Kishengarh area the ordinary deep-blue sodalite occurs, as well as the variety which changes its colour. The felspathoid-bearing syenites of this area show considerable variations over a band some ten miles long and two miles broad. They occur mainly as sill-like intrusions among the Archæan schists, elongated in the direction of the general strike and often themselves both foliated and banded; but occasionally there are non-foliated pegmatitic forms with individual crystals of nepheline (elæolite) a foot or so in diameter. Among the accessory minerals of interest are thulite, cancrinite, and calcite, the last named being regarded as a primary constituent formed direct by consolidation of the magma, as in the case at Sivamalai, in South India, described by Holland in 1901 (Mem. Geol. Surv. Ind., 30, 169-217).

SWEDISH OCEANOGRAPHY.—Among the many valuable publications on Swedish meteorology and oceanography is the record made on certain lightships moored off the coasts of Sweden in the Gulf of Bothnia, the Baltic, and the Cattegat. The data from ten lightships for 1923 has now appeared (Svenska hydrografisk-biologiska kommissionens Fyrskepp-sundersölening). In some cases the data for the year are incomplete, because ice necessitates the withdrawal of the lightship in winter and early spring. The first part of the volumes gives the noon records, including water temperatures at various depths and currents for the days each lightship was functioning. This is followed by salinity records, while the final part has a valuable series of water temperatures at different lightships at various depths in all months of the year for the years 1880 to 1913. This shows some remarkable variations in the Gulf of Bothnia and in the Sound.

BENTONITE.—The Canadian Department of Mines has recently issued an interesting paper on bentonite (Mines Branch, Pub. No. 626, by Hugh S. Spence, 1924), a peculiar clay-like material concerning which very little information has hitherto been available. Bentonite occurs in Wyoming and other western states of America, and appears to be widespread over the prairie provinces of Canada. It is found as a bedded sediment in thin deposits rarely so much as ten feet thick, most of which are of Upper Cretaceous age. Its most curious property is its tremendous swelling power when water is added. The volume at the maximum absorption may be five to thirteen times the dry bulk, and the mixture behaves like a true colloid. Nevertheless, the deposit is mainly composed of minute flakes of the definite mineral leverrierite, $2Al_2O_3 . 5SiO_2 . 5H_2O$. It also contains a noteworthy amount of adsorbed soda, and a further curious feature is that soda is frequently five times as abundant as potash. The origin of bentonite is traced to the hydration of thin water-laid beds of fine vitreous volcanic ash. The clay particles appear to have become dispersed as a suspension which afterwards coagulated and settled. The peculiar properties of bentonite should ultimately

give it an industrial importance, though at present there is only a small demand, largely on account of the high cost of transport. It has already been used as the base of many toilet creams and cosmetics; as a suspending agent in enamel mixtures; in the paper industry; and in the refining of oils and fats. The paper gives a long list of other possible applications, and a bibliography of the literature.

AMERICAN ASPHALT INDUSTRY.—Mr. K. W. Cottrell's report on "Asphalt and Related Bitumens in 1923" (Mineral Resources of the United States, part 2) indicates further progress in this industry, reflected especially in the marketing returns for that year. In the case of natural products the increase amounted to 22 per cent. in quantity and 28 per cent. in value over the previous year. Manufactured asphalt from domestic petroleum, obtained chiefly from refineries in California, Texas, and Illinois, advanced 24 per cent. in quantity and 26 per cent. in value. The total amount of asphalt produced from internal sources during 1923 amounted to 1,395,890 tons, corresponding to a market value of nearly sixteen million dollars. To this must be added 1,378,722 tons manufactured from petroleum imported into the United States from Mexico, from which it may be observed that practically 50 per cent. of the total output of asphalt in America is of Mexican origin. Save for its utilisation in the paper-making industry (see NATURE, December 13, 1924, p. 873) asphalt has apparently not found any new use during the year under review, the bulk still being employed for paving, roofing, and waterproofing purposes, though the rubber industry's demands have been heavier than in previous years. The British Isles is still the largest consumer of asphalt and asphaltic products, Australia, Canada, France, Japan, Spain and Germany following in that order. The American asphalt industry now has its own Asphalt Association, a body composed of manufacturers, consumers and technical experts, whose purpose it is to disseminate practical information. Co-operation of this kind, always a popular movement in the United States, is a sure sign of growing commercial activity in any industry, and in the present instance the trend of events is indicated by the fact that there are no less than forty independent groups operating in the country which are concerned with the production of asphalt and allied bituminous commodities.

THE MERCURY VAPOUR ENGINE.—One of the addresses delivered at the centenary of the Franklin Institute in September last dealt with the mercury vapour engine invented by Dr. W. L. R. Emmet, of the General Electric Company, and it is printed in the February issue of the Journal of the Institute. The mercury is vaporised in a boiler at about 35 lb. per square inch pressure and passes to a mercury turbine coupled to a generator giving about 1800 kilowatts. The waste heat of the vapour leaving the turbine is utilised in a tube steam boiler giving steam at about 200 lb. per sq. in. The condensed mercury runs back by gravitation to the mercury boiler. The furnace gases from the mercury boiler are used to heat the returning liquid mercury, then to superheat the steam raised in the steam boiler, and lastly to heat the feed water for that boiler. The plant has been run for several months at Hartford and has delivered power to the circuits for 800 hours without any troubles of a serious nature arising. A plant of 50,000 kilowatt capacity is to be installed at Chicago and a gain of output of 50 or 60 per cent. as compared with a modern steam turbine plant of that capacity is expected.

COLD-WORKING OF METALS AND HARDNESS.—The issue of *Die Naturwissenschaften* of January 2 contains an interesting article by Masing on the cold-working of metals and the resulting hardness produced, considered in the light of the modern work on single metallic crystals of Carpenter, Elam, and Taylor in Great Britain, and Polanyi, Mark, Schmidt, and Czochralski in Germany. The knowledge now gained is the result of a detailed study of the deformation of single crystal test pieces under stress which involves an experimental determination of the movement of the crystal axes during the test. The work of Taylor and Elam is especially noteworthy in this connexion. In their Bakerian Lecture two years ago they showed that in the distortion of a single crystal test piece of aluminium, the metal was deformed by movement on one octahedral plane up to an extension of 40 per cent. After this the crystal axes had moved in such a way that a second octahedral plane came into the conjugate position, and from there onwards the crystal elongated by being pulled out on two planes. A point of special interest which emerged from their analysis was that the hardening of the crystal was general and not local, since, when the second plane came into position, the metal was equally resistant to distortion along this plane and that along which it had already been elongated. In their recent paper to the Royal Society, Carpenter and Elam showed that the proportional increase in hardening is greatest during the early stages of extension, but that in the case of single crystals a stage is reached when the increase in hardness is approximately proportional to the amount of plastic deformation.

SULPHURIC ACID MANUFACTURE.—The *Chemical Age* for February 7 contains an interesting account of the new Gaillard method of intensive sulphuric acid production. Acid is sprayed on to the walls of an air-cooled lead tower from a "turbo-disperser" at the top. The impact breaks the drops, which then recoil and form in the body of the tower a heavy acid fog. Burner gases are passed up through this fog, which decomposes the nitrosyl sulphate, and condenses the acid already formed. The process has been installed at San Carlos, near Malaga; the yields obtained correspond to a chamber space of 1·2 cu. ft. per pound of sulphur per 24 hours. The process works well with burner gases of both low and high sulphur dioxide content.

FLUCTUATIONS OF ASH AND NITROGEN IN LEAVES.—Jan Wlodek gives some interesting data as to the fluctuations in ash constituents and nitrogen in leaves collected at different hours of the day and night, in the Bulletin de l'Académie Polonaise des Sciences et des Lettres, Séries B, Sciences Naturelles, 1923, pp. 65-78. Many ash constituents show important fluctuations from night to day, these being best seen when the results of analysis are expressed as absolute values per biological unit, the leaf. In all three species investigated (*Phaseolus vulgaris*, *Trifolium pratense*, and *Avena sativa*) the sodium oxide content fell during the night, whilst potassium oxide fluctuated very strongly in Phaseolus, less in Trifolium. Magnesium oxide remained fairly constant; calcium oxide fluctuated irregularly; silica and SO_2 fell markedly during the night; chlorine remained about constant; P_2O_5 fluctuated irregularly. In oats the total nitrogen followed the silica content; in clover it varied irregularly. In oats the protein nitrogen on the other hand increased at night; in clover this also varied without regularity. These somewhat puzzling results are not discussed in the paper.

The Function of the Spleen.

THE number of functions attributed to any organ is often a direct measure of our ignorance as to its real status in the animal economy. The spleen has suffered much from a multiplicity of theories as to its functions, but only two appear to be generally accepted; in fœtal life it acts as one of the sources of the cells of the blood, whilst in the adult these cells, especially the red cells, are here broken down and destroyed when they become worn out. It appears from recent work by Prof. J. Barcroft and his collaborators, an account of which is given in the *Lancet* of February 14, that a further extremely important function must be attributed to this organ; in their opinion it acts as a storehouse for the red cells of the blood, a number of which may be kept there ready to be brought back into the circulation at a time of emergency.

These workers were first led to a study of this question by finding that when the blood volume increases on exposure of the body to a high external temperature, the increase is not entirely due to the addition of fluid alone to the circulating blood, but that at the same time the total hæmoglobin circulating in the blood increases also. There is no evidence of an increase in the number of newly formed red cells until after a few days have elapsed, so that the additional hæmoglobin—and corpuscles containing it—must have come from some store, and not be due to a new formation, at any rate at first; moreover, the rate of appearance of this hæmoglobin is too great for it to be due simply to new formation. In their search for this store of red cells the investigators naturally thought of the spleen; if their supposition was to be considered correct, they must be able to answer in the affirmative these two questions: Is there, in fact, a store of red cells in the spleen, which are usually outside the general circulatory stream? Is the number of these stored cells sufficient to account for the increase in circulating hæmoglobin observed on exposure to a high external temperature?

The answer to the first question was found by an examination of the effects of breathing small amounts of carbon monoxide upon the blood in the spleen. The experiments were conducted upon a number of different animals, and it was conclusively shown that there was a lag in the taking up of this gas by the red cells in the spleen as compared with those in the general circulation. In fact, if the percentage of gas breathed was sufficiently small, the hæmoglobin in the spleen might still contain none after several hours; on the other hand, when the animal was placed again in ordinary air, the carbon monoxide came off from the blood in the spleen much more slowly than from that in the general circulation. The blood in the spleen is thus outside the circulation, but this statement is only true for an animal at rest; in activity the carbon monoxide penetrates into the organ at once, so that under these conditions the stored blood appears to be in circulation. Further experiments have shown that under conditions where the amount of oxygen in the blood is less than normal, as, for example, after administration of carbon monoxide, the spleen is stimulated to contract by impulses from the central nervous system, the amount of blood forced out depending partly on the degree of such stimulation. Although it has been known for a long time that the spleen can undergo variations in size from the contraction of the unstriped muscle fibres it contains, the reason for this contractility is thus only now becoming apparent. Furthermore, bearing this capacity of the spleen to vary its size in mind, it may be asked: What is the real size of this organ? And are its variations in size of sufficient amplitude to account for the increase in circulating hæmoglobin with increase in the blood volume?

Little information on these questions can be derived from a study of the size of the spleen in the dead animal, since we have no means of knowing whether the muscle in it has maintained its *in vivo* length. We should expect to find, in fact, that it has contracted, so that the organ will be smaller than in life; but how much smaller we cannot judge. It is clear that the organ must be examined in the living animal and without subjecting it to any exposure which might stimulate its smooth muscle fibres. Since it is not opaque to the X-rays, Barcroft and his co-workers fastened small metal clips to its edges in the living animal under an anæsthetic. After the wound had healed, X-ray photographs were taken in two planes, and from these it was easy to reconstruct in a model the size and shape of the organ under different conditions; the approximate weight was also ascertainable, after the animal had been killed, by comparing its size and weight after death with the size found during life. It was found that the weight during life might be two to six times that observed after death; in fact, no less than one-sixth of the total blood volume, or one-third of the red cells, might be contained in the organ during life. A comparison of its size at rest and during exercise suggests that an amount of blood equivalent to about one-quarter of the blood volume may be squeezed out of the organ during activity. The evidence appears conclusive that a large amount of blood may be stored in the spleen, available for emergencies.

Finally, since it is known that in man the spleen may be removed without apparent harm to the individual, Barcroft has inquired whether the absence or not of the organ makes any real difference to the organism. He found that animals without spleens died sooner than controls on exposure to an atmosphere containing carbon monoxide. Thus an individual with a spleen will be able to meet an emergency with more success than one from whom the organ has been removed.

Science in Russia.

IT is gratifying to learn from a correspondent that, throughout the troubled period of the past few years, the splendid premises and wonderful collections of the famous Zoological Museum of the Academy of Sciences in Leningrad have scarcely felt the breath of war, famine, pestilence, and revolution which has passed over them. When the English traveller walks in, and is greeted by the famous young mammoth from Siberia, preserved like a recently killed specimen, and sees the rich collections illustrating the fauna of the vast steppes and deserts of Russian Asia, he feels that he is entering into a new world.

During the cold winter of 1919–1920, when fuel was unobtainable, it was impossible to heat the Museum premises, but the staff suffered more than the collections. Little or no looting was done during the disorders, except that the director had some difficulty in preventing the valuable collection of skins from being taken to be used as furs by the shivering population. Far more damage was done

during the severe floods last autumn, when the waters burst into the basement and ground floor, and at least one member of the staff actually saved his own life and that of others by swimming: the library was badly damaged, many valuable specimens were ruined by the water and damp, and great inconvenience was caused by the smashing of the stores of alcohol, which is difficult to obtain to-day in Russia, as the supply is under strict Government control and very limited.

The entomological collections were enriched in 1914 by the generous gift by A. P. Semenov-Tian-Shansky of an immense collection of Central Asiatic Coleoptera, consisting of no less than 800,000 specimens: the same donor last year presented his own collection of Hymenoptera, Diptera, Neuroptera.

The staff of the Zoological Museum consists of ten "senior zoologists," who form a "soviet" and elect their own director, ten "keepers," and eight assistants. The present director is A. A. Bialitsky-Birula, well known from his work upon Arctic zoology, who is also editor of the *Annuaire*. Birds are under the charge of P. P. Sushkin, Member of the Academy, who is well known in Great Britain and the United States. Another name well known outside his own country is that of the entomologist A. P. Semenov-Tian-Shansky, whose many friends will regret the sad news of his failing eyesight. Fortunately, his general health leaves nothing to be desired, and it is to be hoped that he will be spared with capacity for useful work for many years. His father, P. P. Semenov, was a distinguished explorer, who surveyed the Tian Shan mountains, receiving the authority of the Tsar to add the title Tian-Shansky to his surname. Other well-known members of the staff are N. J. Kuznetsov the lepidopterist, G. G. Jacobson the coleopterist, A. K. Mordviko the aphidologist, P. I. Schmidt the ichthyologist, A. N. Kirichenko and A. M. Diakonov, entomologists.

The staff of the Museum are, of course, State officials, and paid at least a living wage: the salary of a senior zoologist is 47 gold roubles a month, equivalent to about 5*l.*: this, of course, leaves no margin for luxuries, but they are at least happy in their devotion to science. Their chief complaint has been the shortage of modern foreign literature, but this is now to a certain extent being made good. There is, however, considerable leeway to make up, and as the postal arrangements are now working satisfactorily, zoologists in England will be doing good work if they bear this in mind.

During recent years it has not been possible to publish the results of research work in agriculture in Russia, since the scanty funds for agricultural publications have been used, in the first place, for publishing popular handbooks and pamphlets. At the same time, research work has been carried on, often under most unfavourable conditions, and a considerable amount of new facts is awaiting publication. The new journal (*Journal für landwirtschaftliche Wissenschaft*, vol. i. Nos. 1-6; Moscow, 1924 (in Russian)), edited by a group of leading professors and research workers of the Moscow Agricultural Academy, aims at becoming a medium for publishing results of research work in all branches of agricultural science. The five numbers (one double) before us now include a great variety of papers on different subjects.

One of the most interesting papers is by A. G. Dojarenko, on the utilisation of solar energy by plants (No. 1, pp. 7-21), which describes the methods used in the author's experimental work for exact measurements of solar energy both received and utilised by cultivated plants, and gives interesting, though only preliminary, conclusions. Of considerable general interest is a paper by A. R. Minenkov (No. 1, pp. 29-47) dealing with the problem of chemical determination of sex in plants and in animals; the results of his experimental work are that both in plants and in animals there is a definite sexual difference in the fermenting properties of extract (plants) or blood (animals) which enables one to determine the sex. A. D. Prianishnikov (No. 3, pp. 179-190) describes experiments on the transformation of nitrogen compounds in plants and in animals, the author's conclusion being that the analogies in this respect are very far-reaching and suggest a close similarity of processes in plants and in animals. In a paper by V. Israilsky and E. W. Runov the question of the action of vitamins on bacteria is discussed and experiments described, which tend to show that bacteria are very sensitive to vitamins. G. D. Karpetchenko (No. 5-6, pp. 390-410) describes hybrids between two plants of different genera, *Raphanus sativus* L. and *Brassica oleracea* L.; an exhaustive study of the morphology and cytology of hybrids is given. These are only a few of the more interesting papers from the journal, which represents, on the whole, an important step in the development of agricultural science in Russia. The value of the journal to Russian agricultural research workers is greatly enhanced by abstracts of current literature.

University and Educational Intelligence.

BIRMINGHAM.—The Council of the University at its meeting on March 4 decided to go forward with its purpose for erecting further buildings at Edgbaston to accommodate the three biological departments, botany, zoology, and brewing, with the fermentation industries. The approximate estimate of expenditure is 90,000*l.*-100,000*l.*, and the scheme is only rendered possible by a very generous donation from Mr. W. Waters Butler of 35,000*l.* Another donation to the fund of 5000*l.*, given anonymously, was also reported. The Biological Departments are at present quite inadequately housed in Edmund Street, and the release of the space in the Edmund Street buildings will enable rearrangements to be made there to facilitate the work of the Faculties of Arts and Medicine, and the new Department of Law. When the University was founded in 1900, an imposing scheme for the site at Edgbaston was planned by Sir Aston Webb. Substantial progress had been made when the present buildings were opened by King Edward in 1909. The War and its economic consequences, however, prevented further progress. The new biological block is a resumption, long delayed, of the original plans.

CAMBRIDGE.—It is proposed to confer Honorary Degrees upon Prof. John Joly, professor of geology and mineralogy in the University of Dublin, and on Mr. A. P. Maudslay.

The Board of Archæological and Anthropological Studies is recommending certain changes in the regulations for the diploma in anthropology. One change would throw open the diploma to any officer of one of the public services of the Empire, not ordinarily resident in the British Isles, who has resided and received instruction in anthropology in Cambridge during three terms or, in the case of an officer possessed of exceptional qualifications, during one term only.

LEEDS.—The degree of Doctor of Science has been awarded to Mr. H. Hunter for his thesis on "The Improvement of the Barley Crop"; and the degree

of Doctor of Medicine to Mr. C. G. K. Sharp for his thesis on "Bilharzia Disease." Dr. Sharp is the Chief Medical Inspector of Schools, Pietermaritzburg.

LONDON.—A course of three free public lectures on "The Cretaceous Vegetation of Greenland" will be delivered at University College on March 17, 20 and 24, at 5.30, by Prof. A. C. Seward. No tickets will be required.

MANCHESTER.—The Council has appointed Dr. F. Craven Moore, lecturer in systematic medicine, to the chair of systematic medicine in the University. Dr. Craven Moore is the author of numerous papers, chiefly in connexion with diseases of the alimentary canal and metabolic medicine, among which may be mentioned "Cholesterin" and "Diseases of the Stomach" (Practical Encyclopedia, Medical Treatment, 1915); "Compensatory and Regenerative changes in the Liver," *British Medical Journal*, 1908; and "The Rôle of Fats in Treatment of Disorders of Stomach" (with Dr. Ferguson), *Lancet*, 1909.

OXFORD.—The first annual report of the committee for the Lewis Evans collection of scientific instruments has just been issued by Mr. R. T. Gunther, fellow of Magdalen College, the Curator. The collection, which has now been appropriately housed in the Old Ashmolean Building, has received several important accessions in the course of the year. Interesting exhibits have also been deposited on loan by various colleges and by private collectors, and good progress has been made in the arrangement and labelling of the collection. That it has been possible to issue so favourable a report of progress in the proper display of this valuable collection is mainly due to the zeal and energy of Mr. Gunther. The collection is to be officially opened on May 5, when the Earl of Crawford and Balcarres will deliver an address.

An examination for the Theodore Williams medical scholarship at Pembroke College, Oxford, will begin on June 9. The scholarship is of the annual value of 100*l.* and is tenable for either four or five years. Further particulars may be had from the senior tutor of the college.

DR. OTTO FISCHER, professor of chemistry at the University of Erlangen, who is retiring shortly, will be succeeded by Prof. Rudolph Pummerer of Griefswald.

DR. ADOLPH HEILMANN, chief engineer of the municipal waterworks at Dresden, has been nominated to a professorship at the Technische Hochschule in Dresden.

DR. WALTER GOSSNER, professor of mineralogy at the University of Tübingen, has been invited to occupy the chair of mineralogy and crystallography at the University of Munich.

APPLICATIONS are invited for the chair of agriculture in Auckland University College, New Zealand. Particulars are to be had from the High Commissioner for New Zealand, 415 Strand, W.C.2. The completed forms must be returned by, at latest, March 31.

APPLICATIONS for not more than two Ramsay Memorial Fellowships for Chemical Research (one limited to candidates educated in Glasgow) are invited. The annual value of each fellowship is 250*l.*, to which not more than 50*l.* for expenses may be added. The fellowships are normally tenable for two years with a possible extension for a further year. Applications must reach the Secretary of the Ramsay Memorial Fellowship Trust, University College, Gower Street, W.C.1, by June 6 at latest.

THE SCHOOLS RADIO SOCIETY, a section of the Radio Society of Great Britain, is arranging a Schools Radio Exhibition to be held at the L.C.C. Beaufoy Technical Institute, Princes Rd., Vauxhall Street, S.E., on March 14-18. Approximately 40 schools are exhibiting, consisting of members of the Schools Radio Society, L.C.C. Schools, and Technical Institutes. Apparatus made by scholars and sets used in schools will be shown together with schemes of school wireless work, and there will be a special display and demonstration by the British Broadcasting Company of what they consider to be the ideal set for broadcast reception. Admission to the exhibition is by purchase of a programme or by invitation to be obtained from the Secretary, Schools Radio Society, St. Paul's School, Dorking.

AT the meeting of the Association of Technical Institutions on March 6 and 7, Mr. G. Mavor, head of the Department of Continuative Education at Loughborough College, in a paper on the conditions of training and education of apprentices, stated that the response to the appeal for information on the subject sent out to the leading firms in a great number of trades had been unsatisfactory as only about 10 per cent. had replied. From the replies received, it is, however, evident that while there may be a feeling in favour of apprenticeship, neither the trade unions nor the employers appear to be willing to enforce it. Where it exists, it is generally of the unindentured form, for 5 years, and not of an all-round type. In some cases the local technical schools are asked to provide evening classes, but in the works the training is generally restricted to one branch, with the possibility of unemployment if the demands on that branch decrease. To effect reform, Mr. Mavor advocates the raising of the school leaving age to 16 and the provision of part daytime education for all employees up to the age of 18. Some firms have already adopted the latter, and others encourage their employees to attend evening classes, but State action is necessary if the requisite number of "warrant officers" for future industrial progress is to be produced.

TEACHERS in technical and evening schools are being offered some very attractive short courses of instruction to be held next summer under arrangements made by the Board of Education at Birmingham, London, Oxford, Cambridge, and Harrogate. The University of Birmingham is co-operating with the Board in the provision of courses in engineering science and electrical engineering at Birmingham and Oxford and in mining engineering at Birmingham. Prof. Burstall, Dean of the Faculty of Science, Profs. Batho, Cramp, Lea, Moss, J. S. Haldane, MacGregor Morris, J. S. Townsend, and other members of the University will deliver lectures and conduct demonstrations, tutorial classes, and discussions on teaching methods, and there are to be evening lectures by other eminent authorities in science and engineering. The power house of the University as well as its departmental laboratories will be at the disposal of the instructors, and the University halls of residence will be used for the accommodation of those attending the courses. At Oxford teachers attending the courses will be lodged in Oriel College. At Cambridge a course in commercial subjects will be conducted at one of the colleges. The courses in London will include building and surveying subjects and textile subjects. The Board is to bear the cost of travelling to and from the places of instruction and to contribute a pound a week towards the cost of maintenance. Applications to attend must be sent to the Board before March 21.

Early Science at Oxford.

March 16, 1685–6. Dr. Garden of Aberdeen communicated his observations on the weather at Aberdeen in October, November and December 1685. Dr. Plot read a discourse concerning ye old Almanacks lately communicated by him; this will be printed in ye Doctor's History of Staffordshire.

Mr. Thomas Wickam communicated the case of a Colt foaled with one of ye feet turned, ye heel standing forward, and ye toe backward, which being broken was set right, and grew together again so well, that ye Colt proved as serviceable a horse, as any of his condition thereabout.

March 17, 1684–5.—With a letter from Mr. Aston came ye Minutes of ye Dublin Society from December 1 to Feb. 23, 1684–5 inclusive. Orders were given, that the thankes of our Society be returned for these Minutes, and that copies of Sir William Petty's *Supellex Philosophica*, and of Mr. Brownlow's answers to ye Queries sent him concerning Lough-Neagh, be desired.

A draught of Mr. Beaumont's designe for writing ye History of ye Nature and Arts of the County of Somersett, was communicated.

Dr. Plot presented a Catalogue of some of ye most considerable Arcana and Desiderata in Chymistry as, followes:—To reduce any of ye Metalls into a reall fluid. To turne ye whole body of mercury into a clear Diaphanous water wetting ye hands. To transmute one Metalline Species into another, especially ye baser, into gold and silver, either by projection, Cementation, Commixtion, or Digestion. To make the liquor Alkahest, which will dissolve all bodies whatever, except its Compar, and what it is. To Sublime Antimony in it's own forme, black and striated. To make a Menstruum, not corrosive, that shall perfectly dissolve all ye Metalls, particularly Gold and Silver. To make urinous volatile Salt, or Spirit, from most Vegetables. To make in good Quantity an Urinous Salt, and Spirit out of a Mineral with little cost. To Mummiate an Animal entire without opening, or taking out the intestines, or giving to ye flesh any taste, colour, or smell. To make glasse malleable. To make many fragments of Diamonds, or other precious stones into one.

March 18, 1683–4.—It was ordered that there be no election of Members into ye Philosophical Society, unless there be nine Members (at least) present, to make such election; which Article, with 13 others, agreed on March 11th, 1683–4, being entred in ye Journal Book, were subscribed, by Dr. John Wallis, Savilian Professor of Geometry; Dr. Ralph Bathurst, President of Trinity; Dr. Beeston, Warden of New College; Dr. Th. Smith, Fellow of Magdalen; Dr. Robert Plot, Professor of Chymistry, and Keeper of ye Musæum Ashmoleanum; Dr. William Gibbons, St. Johns; Edward Bernard, Savilian Professor of Astronomy; Jos. Pulleyn of Magd. Hall; John Caswell of Hart Hall; Th. Piggot, of Wadham; S. Des-Masters, of Oriel; J. Ballard and W. Musgrave, of New College; S. Welsted, of Merton.

We then passed to other Business. Mr. Ballard informed ye Society, that ye Amianthus, on which his experiments were tried, was brought from Cyprus, by Dr. Huntingdon, and communicated to us by Dr. Plot.

Manganese (a minerall, dug no where in England, but on Mendip-hills and used in ye purifying of glass) was not of itself affected by ye Magnet; but after above three hours calcination, it readily consented to it; as was shewn us by Dr. Plot. But Irish slate, calcined about four hours, could not be wrought on by ye Magnet; which gave Dr. Plot an occasion to draw up a discourse concerning severall Minerall waters, commonly thought to be Vitrioli.

Societies and Academies.

LONDON.

Royal Society, March 5.—Sir Arthur **Schuster**: On the life statistics of fellows of the Royal Society. A revision and extension of a statistical inquiry made by Lieut.-Gen. R. Strachey towards the end of last century. Its principal results are: (1) The average age at election remained fairly constant between the years 1848, when the nominations for election were placed into the hands of the Council, and the end of the century, the average being 44·4 years. There has been a decided increase since then, more especially in the last ten years, but some of this may have been due to war conditions. (2) The average age of fellows on January 1, 1923, was 60·9 years. (3) Their expectation of life is about 6 years greater than that recorded in the tables published in "Whitaker's Almanac" as applying to the entire population of England.—G. I. **Taylor** and Miss C. F. **Elam**: The plastic extension and fracture of aluminium crystals. In the early stages of the tests under direct tension the previous results are confirmed, and the nature of the distortion in the later stages is now proved to be due to slipping on the two crystal planes previously indicated. After double slipping has begun, the rate of slip on the original slip-plane is usually greater than that on the new one. The geometrical conditions with a shearing-stress parallel to the slip plane are such that the crystal is quite stable while the slip occurs on one plane, but as soon as double slipping occurs, it becomes far less stable, or even unstable. Therefore the specimen usually breaks before it has slipped far on the second plane, but never before the double slipping begins.—A. **Fage**: An experimental study of the vibrations in the blades and shaft of an airscrew. The sounds emitted were analysed with 4 Tucker hot-wire microphones used in conjunction with a four-valve amplifier. The sounds of rotation which arise from the rotation of the source-and-sink system associated with the pressure differences on the blades are composed of a large number of harmonics, having as fundamental a note of frequency equal to the product of the number of blades and the rotational speed. The natural frequencies of flexural vibration were measured for four-blade shapes, the variables of design being width and geometrical pitch. The measured frequencies of the shaft vibrations agree very closely with the calculated results, except for a discrepancy of 8 per cent. obtained on the heaviest airscrew.—J. H. **Vincent** and A. L. **Beak**: Experiments on the effects of resistance in the oscillating circuit of a triode. The circuit employed is that previously used by Eccles and Vincent. In this the main oscillator consists of a condenser and coil in series, the coil being variably coupled to the grid coil which is in conductive connexion with a point between the condenser and main coil, the opposite point being joined to the negative end of the plate battery; these two points divide the main oscillating circuit into two branches, inductive and capacitive. With this apparatus the conditions were studied under which oscillations could be started and maintained, and the changes in frequency of oscillations and the simultaneous changes in the oscillating and mean plate currents, due to altering resistances in the inductive and capacitive branches of the oscillating circuit. The chief results support Eccles's control equation, but disagree with his formula for changes in frequency. G. H. **Hardy**: The lattice points of a circle. Proof of the fundamental identity in the problem of the circle by means of a singular integral the kernel of which is a theta-function, with an application to a theorem of J. E. Littlewood and A. Walfisz, published

recently in the Proceedings.—H. M. **Macdonald**: The transmission of electric waves around the earth's surface. The transmission of wireless signals to great distances and other phenomena associated with wireless telegraphy have been ascribed to the presence of a conducting layer in the upper atmosphere. Such a layer, if it were conducting in the ordinary sense, would act as a screen in respect of electrical effects having their origin external to the layer, and electrical disturbances set up in the space between the earth's surface and the conducting layer would subside very slowly. It appears natural, therefore, to assume that, if there is reflection from the upper atmosphere, there must also be radiation through it, to allow a steady state to be attained in a comparatively short time. The simplest hypothesis consistent with this is that the upper atmosphere differs from the lower atmosphere in respect of the constants involved in the propagation of electrical effects, namely, the specific inductive capacity and the magnetic permeability. On this hypothesis the condition that a steady state of electrical oscillation can be set up in the lower atmosphere in a comparatively short time is investigated. Taking an ideal case, the condition is that the ratio of specific inductive capacities is approximately equal to the ratio of magnetic permeabilities.—R. M. **Wilmotte**: On the field of force near the neutral point produced by two equal coaxial coils with special reference to the Campbell standard of mutual inductance. The accuracy of any apparatus depending on the mutual inductance between two coils and another coil situated at the neutral circle formed by the magnetic field of the first two coils depends largely on the variation of the magnetic force near the neutral circle. An expression in terms of the magnetic forces produced by a circular current is obtained for the variation of the mutual inductance due to a small displacement from the neutral circle of a single turn of wire acting as the secondary to two co-axial single-layer coils.—W. R. **Dean**: On the theory of elastic stability: After Hooke's Law has been extended, two methods are available. The three conditions for the equilibrium of an elementary volume may be written down, correctly to the second order, by considering the forces acting upon it, or the strain energy may be calculated to the third order, and the equations obtained by variation. With a cylindrical shell the energy method is shorter. The equations refer in the first instance to the displacements of any point of the shell. To reduce them to equations connecting the displacements of points of the middle surface only, the displacements of any point are expanded in series of the distance of this point from the middle surface, and the boundary conditions at the faces are used.—R. A. **Frazer**: On the motion of circular cylinders in a viscous fluid. The paper is restricted to two-dimensional flow, and deals primarily with the motion of circular cylinders in fluids of great viscosity, inertia terms being neglected. The flow due to a stationary cylinder immersed in a uniform infinite river is treated as the limiting case of flow between two concentric boundaries, the stream being uniform over the outer, and stationary over the inner. The essential elements for a solution are obtained with arbitrary velocity distributions specified over any two mutually external circular cylinders. The stream-function is completed for the case where the cylinders are in steady rotation. Another type of motion investigated is where two spinning cylinders are rotated as a "planetary" system about a particular "focus." The cases examined include "planetary" systems, problems of contact, and the combined rotation and translation of a cylinder in proximity to a wall.

Geological Society, January 21.—Léon W. **Collet**: The latest ideas on the formation of the Alpine range. In 1905 Prof. E. Argand determined in the Pennine Alps the existence of six great recumbent folds or nappes. On the base of Argand's results, Dr. R. Staub found in the north-eastern part of the Swiss Alps the same tectonic elements, covered by six higher nappes belonging more to the type of the "thrust-masses" of the North-Western Highlands of Scotland than to the type of the recumbent folds of the Pennine Alps. This new series of nappes has been named by Staub the Austrides, for they form the main part of the Austrian Alps. Prof. L. Kober's discovery of a window or horizontal cut, due to erosion, in the nappes of the Austrides, revealing deeper nappes belonging to the Pennine series, shows that the nappes of the Austrides have been thrust over the Pennine nappes in the Austrian Alps, just as in the north-eastern part of Switzerland. Co-ordination of the work by Austrian and Swiss geologists was accomplished at the end of last year by Dr. Staub. Wegener's ideas on the drifting of continental masses are employed to explain the movement of the hinterland towards the foreland of the geosyncline. Foreland and hinterland constitute the boundaries of the great Alpine geosyncline: together they recall the two jaws of a vice. Prof. Argand has shown that the nappes of the Austrides belong to the hinterland: that is, to Africa or Gondwanaland. Therefore the Austrides, with the Préalpes, represent a small part of Africa resting on Europe or Eurasia.

February 4.—A. **Heard**: The petrology of the district between Nevin and Clynnogfawr (Carnarvonshire). Drift obscures most of the valleys, and conceals the greater part of the areas underlain by unaltered shales. Most of the sedimentary rocks consist of dark purplish-grey shales of *Didymograptus-bifidusage*, together with their metamorphosed representatives. In the north-western part of the area unfossiliferous pale-grey shales containing numerous ashy and fine-grained gritty bands are present. A large proportion of the exposed rocks consists of an igneous complex of post-Lower Arenig—pre-Old Red Sandstone age. The intrusive rocks present many petrological variations, including numerous different types of granite and quartz-porphyries, granophyres, porphyries of intermediate composition, and basic rocks. The "banding" of the constituents of the coarser-grained intrusive masses is peculiar. Neither hybridism nor any apparent chilling is exhibited at the junction of adjacent "bands," and the uppermost band invariably consists of the most basic rock.

CAMBRIDGE.

Philosophical Society, February 2.—L. F. **Curtiss**: A preliminary note on a direct determination of the distribution of intensity in the natural β-ray spectrum of radium-B and radium-C. The number of electrons in each small range of velocity in the β-ray spectrum of radium-B and -C is measured by observing the charge communicated to a Faraday cylinder. The advantage is that full weight is given to every portion of the spectrum, and errors due to the variation of ionisation with velocity are avoided. Since in this method it was unnecessary to have any covering over the mouth of the Faraday cylinder, it was possible to investigate very low velocities, and an interesting emission was found about 250 $H\rho$.—C. D. **Ellis** and W. A. **Wooster**: Note on the heating effect of the γ-rays from radium-B and radium-C. The chief difficulty in this determination is due to the presence of the α-rays from radium-C; they produced a heating

one hundred times as great as that due to the γ-rays. This was overcome by an automatic compensation method. The rise in temperature was measured by means of thermocouples and the equivalent amount of heat found by calibration experiments with heating coils. The amount of radium-B +C in equilibrium with 1 gram of radium emits 8·1 cal./hour in the form of γ-rays.—C. D. **Ellis** and M. **Bowman-Manifold**: The interpretation of β-ray absorption curves. The approximate exponential absorption curves are due to the initial heterogeneity of the radiation. The absorption curve of a continuous spectrum can be explained by the superposition of the linear absorptions of the β-rays contained in each small range of velocities. The form of the continuous spectrum is simply related to the second differential coefficient of the absorption curve.—D. **Stockdale**: A thermostat for high temperatures. The instrument is designed to control the heating of electrical resistance furnaces. The electro-motive force given by a thermocouple, the hot junction of which is placed in the furnace, is balanced against the fall of potential along a wire. If the system is not in equilibrium, a galvanometer is deflected, and a boom carried by this galvanometer touches a wheel; an electrical circuit is closed and a relay is actuated in such a way that the current heating the furnace is altered until equilibrium is again established. It was fairly easy to maintain any temperature up to 1000° C. with a fluctuation of not more than 3° C.—W. G. **Palmer**: A method of finding the composition of adsorption films of mixed gases. The gas in an adsorption layer between two fine metallic filaments in mechanical contact can be removed, and metallic contact established by applying to the junction an electric stress, the value of which is characteristic of a particular gas and adsorbing material. When a bare surface first comes into contact with a mixture of gases, the composition of the initial film formed is directly calculable from the partial pressures and molecular weights of the gases. This film will in general change in composition to an equilibrium value. The composition of this final film is given by plotting the relation between electric stress required to remove the initial film and the composition of this film.—A. P. **Cary** and E. K. **Rideal**: The spreading of oils and fats on water surfaces.—W. **Saddler**: Triple binary forms; the complete system for a single (1, 1, 1) form with its geometrical interpretation.—W. **Burnside**: On the phrase "equally probable."

DUBLIN.

Royal Dublin Society, January 27.—G. **Brownlee**: The interpretation of certain empirical standards in their application to Irish butter. An investigation of a large number of samples of butter, collected from various creameries by the inspectors of the Department of Agriculture and Technical Instruction of the Irish Free State, has shown that, during the months of November, December, and January, the Reichert-Wolny number of Irish butter is usually below the value 24, which is generally taken as the lower limit for pure butter. This is in agreement with the results of a previous investigation carried out some years ago. The values obtained for the other numbers used for defining the properties of butter also frequently fell outside the limits generally assumed to be applicable to pure butter.—E. A. **Werner**: The decomposition of certain amino acids by alkaline hypobromite.

ROME.

Royal Academy of the Lincei, November 2.—F. **Zambonini** and G. **Carobbi**: Double sulphates of rare earth and alkali metals. I. Double sulphates of lanthanum and potassium. Systematic study of the ternary systems composed of these two sulphates and water shows the existence of six compounds containing $La_2(SO_4)_3$, K_2SO_4 and H_2O in the molecular proportions, 1 : 5 : 2, 1 : 4·5 : 2, 1 : 4 : 1, 1 : 3 : 0, 2 : 3 : 8, and 1 : 1 : 2 respectively.—Ferruccio **Zambonini** and V. **Caglioti**: Double sulphates of rare earth and alkali metals. II. Double sulphates of neodymium and potassium. In this case the molecular proportions of the components of the double salts are 1 : 5 : 2, 1 : 4 : 2, 1 : 4 : 1, 1 : 3 : 2, 2 : 3 : 8, and 1 : 1 : 2.—V. **Ronchi**: An interferential method for the direct determination of the constants and aberrations of divergent optical systems. The method of combination fringes previously applied to convergent optical systems is simplified by the use of an auto-collimating arrangement as so to require only a single grating.—Dino **Bigiavi**: Action of nitrous acid on the azophenols. With nitrous acid, *p* : *p*′-dihydroxyazophenol yields a dinitroazophenol, and is also partly oxidised to *p*-nitrophenol, the diazo-group undergoing rupture; benzeneazo-α-naphthol also appears to suffer oxidation, whilst other azo-phenols yield diazonium salts, together with products not yet investigated.—G. **Carobbi**: Double nitrates of metals of the cerium group with copper and with cadmium. Compounds of the type $2X(NO_3)_3$, $3Ca(NO_3)_2$, $24H_2O$, where X represents Nd, Pr, Sm, and of the type $2X(NO_3)_3$, $3Cd(NO_3)_2$, $24H_2O$, where X represents La, Ce, Nd, are described; by means of the double nitrates formed with copper, lanthanum may be separated from præseodymium.—Gustavo **Cumin**: Geological data on the Istrian mountain region. II. Tectonics and morphology.—Marcello **Boldrini**: Internal and external measurements of certain long bones in man and in woman. II. Measurement of the intensity of the secondary sexual characters.—Cesare **Artom**: Numerical disproportion of the sexes in *Gambusia holbrooki* (Grd.) analysed as to its manifold causes. For most generations of the top-minnow, the numerical relation of the sexes at birth is 1 : 1, but in one autumnal generation a predominance of females was observed.—Boldrino **Boldrini**: Biological reactions observed in the blood serum of woman during and after the lacteal decline: II. Demonstration of an agglutinin of the globules of human milk.—Primo **Dorello**: Contribution to the knowledge of the biology of the nemasperms in the pulmonated gasteropods.—Carlo **Jucci**: Bivoltinism and parthenogenesis in silkworms (*Bombyx mori*).—Sergio **Sergi**: Myorabdotic cellular groups in the cervical region of the spinal medulla of the chimpanzee.

November 16, 1924.—Luigi **Bianchi**: A class of pairs of stratifiable rectilinear congruences.—G. **Bruni** and G. R. **Levi**: Solid solutions between compounds of elements of different valencies. The formation of solid solutions of lithium and magnesium fluorides, previously indicated by the results of thermal analysis of the system, is confirmed by X-ray examination. The substitution of magnesium fluoride molecules for a corresponding number of double lithium fluoride molecules produces neither an appreciable alteration in the lithium fluoride lattice nor the appearance of new lines in the photograms.—F. **Zambonini** and V. **Caglioti**: Double sulphates of the rare earth and alkali metals. II. Neodymium and potassium sulphates. Descriptions are given of the various double sulphates previously found. Federico **Sacco**: An opened nummulite.—J. **Pérès**: Transformations which maintain the composition.—Bruto **Caldonazzo**: Differential geometry of surfaces of hydrodynamic interest.—Umberto

Crudeli: Rhombic systems with uniform rotation in electronic dynamics.—Paolo Stranco: Theory of Einstein fields with axial symmetry.—Guido Horn d' Arturo: Flying shadows visible during solar eclipses.—Rita Brunetti: Fine structure of the helium line 5876 Å.U.—G. Carobbi: Double chromates of rare earth and alkali metals. I. Lanthanum and potassium chromates. Investigation of the isotherm for 25° reveals the existence of double salts containing $La(CrO_4)_3$, K_2CrO_4, and H_2O in the molecular proportions, 1 : 1 : 2, 1 : 3 : 2, 1 : 4 : 2, 1 : 4·5 : 2, and 1 : 5 : 2, these corresponding with the proportions found in the double sulphates of the same metals, excepting that, in the latter case, the 1 : 3-compound is anhydrous, and the 1 : 4-salt monohydrated.—Roberto Savelli: Genetic value of the process of ionolysis of gametes.—Marcello Boldrini: Internal and external measurements of certain long bones in man and in woman. III. The volume of the medullary cavity and hematopoiesis in the two sexes.—A. Clementi: Adaptation of tadpoles to the chemico-physical conditions of the surrounding medium.—Boldrino Boldrini: Biological reactions observed in the blood serum of woman during and after the lacteal decline. III. Demonstration of the existence of proteolytic enzymes capable of hydrolysing the proteins of human milk.—Carlo Jucci: Varying proclivity to parthenogenesis in different races of silkworms (*Bombyx mori*) and its probable correlation with the varying tendency to bivoltinism.—Sergio Sergi: Myorabdotic cellular groups in the thoracic region and the limits between the thoracic and lumbar regions in the spinal medulla of the chimpanzee.

VIENNA.

Academy of Sciences, January 8.—K. Umrath: The conduction of excitation in the leaf of *Mimosa pudica*. The velocity of conduction is discontinuous and is dependent on the nature and strength of the stimulus. The separate stages may be ascribed to separate conducting systems. The velocity is less in the leaflets than in the secondary leaf-stalk, and less in them than in the primary leaf-stalk. The system of greatest velocity is in the chief bundles.—T. Ciuropajlowicz: Two proofs of Fermat's great theorem.—L. Waldmann: Report on the geological survey of Moravian territory between Eggenburg, Pernegg, and Theras. A series of orthogneiss intrusions and strata of rocks of sedimentary origin.—G. Weissenberger, F. Schuster, and K. Wojnoff: Molecular compounds of the phenols. VI. The behaviour of hydrated cresols and allied compounds.—L. Moser and E. Reitschl: The determination and separation of the rare metals from other metals. VI. Determination of the solubility and sensitiveness of complex compounds of cæsium and rubidium and their application in analysis. For quantitative analysis only the chloroplatinate, perchlorate, and bitartrate come into consideration. A quantitative separation was not attained. There is no special cæsium or rubidium reagent, only sensitiveness is decisive. The best indication is given by silico-molybdic acid, by which potassium is not precipitated. Phosphotungstic acid is still more sensitive, but precipitates potassium also.

Official Publications Received.

University of London: University College. Report of the University College Committee (February 1924–February 1925), with Financial Statements (for the Session 1923–24), and other Documents, for Presentation to the Senate. Pp. 101. (London.)

Smithsonian Institution: United States National Museum. Report on the Progress and Condition of the United States National Museum for the Year ended June 30, 1924. Pp. ix+205. (Washington: Government Printing Office.) 65 cents.

Journal of the College of Agriculture, Hokkaido Imperial University, Sapporo, Japan. Vol. 13, Part 3: On the Phenomena of Sex Transition in *Arisaema japonica* Bl. By Tokujiro Maekawa. Pp. 217-305+1 plate. Vol. 15, Part 2: Das Urogenitalsystem der Urodelen. Von Samuro Yamagiwa. Pp. 87-82+4 Tafeln. (Sapporo.)

Department of Commerce: U.S. Coast and Geodetic Survey. Serial No. 276: Results of Observations made at the United States Coast and Geodetic Survey Magnetic Observatory near Honolulu, Hawaii, in 1921 and 1922. By Daniel L. Hazard. Pp. 100+4 charts. Serial No. 282: Results of Observations made at the United States Coast and Geodetic Survey Magnetic Observatory at Sitka, Alaska, in 1921 and 1922. By Daniel L. Hazard. Pp. 100+10 charts. (Washington: Government Printing Office.) 25 cents each.

Ceylon Administration Reports for 1923. Department of Agriculture: Report of the Director of Agriculture for 1923. Pp. D54. (Peradeniya.)

Report on the Operations of the Department of Agriculture, Madras Presidency, for the Official Year 1923-24. Pp. 48. (Madras: Government Press.) 6 annas.

Memoirs of the Geological Survey of India. Vol. 48, Part 2: The Geology of parts of the Persian Provinces of Fars, Kirman and Laristan. By Dr. Guy E. Pilgrim. Pp. iv+116+xiii+plates 11-16. (Calcutta: Government of India Central Publication Branch.) 3.12 rupees; 6s. 2d.

Koninklijk Magnetisch en Meteorologisch Observatorium te Batavia. Verhandelingen No. 8: Het Klimaat van Nederlandsch-Indië (The Climate of the Netherlands Indies). Deel 1 (Vol. 1), Algemeene Hoofdstukken (General Chapters), Aflevering 7 (Part 7). With English Summaries. Pp. iv+417-497+199-248. (Batavia.)

Forest Research Institute, Dehra Dun, (U.P.), India: Economic Branch. Testing of Raw Materials: Scheme of Operation No. 1 for Project No. 5, Paper Pulp Section. By W. Raitt. Pp. iii + 10. (Calcutta: Government of India Central Publication Branch.) 5 annas; 6d.

Publications of the South African Institute for Medical Research. Edited by Dr. W. Watkins-Pitchford. No. 18: An Investigation into the Significance of Localized and more or less Persistent Râles in the Marginal Areas of the Lungs of apparently Healthy Natives. By Dr. W. Watkins-Pitchford and Dr. Peter Allan. Pp. 35. (Johannesburg.) 5s.

Calendario della Basilica Pontificia del Santissimo Rosario in Valle di Pompei pel 1925. Pp. 256. (Valle di Pompei.)

First Greenwich Catalogue of Stars for 1925·0. Catalogue of 2643 Stars from Observations with the Transit Circle made at the Royal Observatory, Greenwich, during the Years 1915–1921, under the Direction of Sir Frank Watson Dyson. Pp. xix+68. (London: H.M. Stationery Office.) 20s. net.

Astronomical and Magnetical and Meteorological Observations made at the Royal Observatory, Greenwich, in the Year 1922, under the Direction of Sir Frank Dyson. Pp. 8+A57+B4+C2+Dix+D51+E5+Exxi+ES4+20. (London: H.M. Stationery Office). 35s. net.

Publikationer fra det Danske Meteorologiske Institut. Aarbøger. Isforholdene i de Arktiske Have (The State of the Ice in the Arctic Seas) 1924. Pp. 38+5 maps. (København: G. E. C. Gad.)

The Marine Biological Station at Port Erin (Isle of Man). Supplement to Thirty-eighth Annual Report. List of the Published Works of the late Sir William A. Herdman, C.B.E., F.R.S., D.Sc., etc. Arranged by E. Catherine Herdman. Pp. 25. (Liverpool: University Press of Liverpool, Ltd.; London: Hodder and Stoughton, Ltd.)

Journal of the Marine Biological Association of the United Kingdom. New Series, Vol. 13, No. 3, March. Pp 531-754. (Plymouth.) 6s. net.

Journal of the Chemical Society: containing Papers communicated to the Society. 1925, Vol. 127, February. Pp. iv + viii + 305-498. (London: Gurney and Jackson.)

Journal of the Chemical Society. Supplementary Number, containing Title-pages, Contents and Indexes. 1924, Vol. 125. Pp. 2699-2796+xxx +4. (London: Gurney and Jackson.)

Abstracts of Chemical Papers issued by the Bureau of Chemical Abstracts. A: Pure Chemistry. Supplementary Number, containing Title-pages and Indexes. 1924, Vol. 126. Pp. ii.877-ii.1304 + 20. (London: Gurney and Jackson.)

Transactions and Proceedings of the Perthshire Society of Natural Science. Vol. 8, Part 1, 1923-24. Pp. 15+xv+5 plates. (Perth.)

U.S. Department of the Interior. Annual Report of the Commissioner of Education to the Secretary of the Interior for the Fiscal Year ended June 30, 1924. Pp. iii+32. (Washington: Government Printing Office.) 5 cents.

Diary of Societies.

SATURDAY, MARCH 14.

ROYAL INSTITUTION OF GREAT BRITAIN, at 3.—Sir Ernest Rutherford: The Counting of the Atoms (III.).

INSTITUTE OF BRITISH FOUNDRYMEN (Lancashire Branch) (at Manchester College of Technology), at 4.—G. Edgington: Oil-Sand Cores.

SUNDAY, MARCH 15.

C.B.C. SOCIETY FOR CONSTRUCTIVE BIRTH CONTROL AND RACIAL PROGRESS (at Criterion Theatre, Piccadilly Circus, W.), at 3.—Dr. H. M. Telling, Dr. M. Thomson, Dr. Jane L. Hawthorne, Dr. Marie Stopes, and others: Why Doctors Disagree about Birth Control.

MONDAY, MARCH 16.

ROYAL IRISH ACADEMY, at 4.15.

ROYAL GEOGRAPHICAL SOCIETY (at Lowther Lodge, Kensington Gore), at 5.—R. D. Oldham: The Portolan Maps of the Rhône Delta.

INSTITUTION OF AUTOMOBILE ENGINEERS (Loughborough Graduates' Meeting) (at Loughborough College), at 7.—E. R. Caffyn: A Few Features of Early Car Design.

INSTITUTION OF ELECTRICAL ENGINEERS (Mersey and North Wales (Liverpool) Centre) (at Liverpool University), at 7.—Informal Discussion on The Application of Electricity on Board Ship.

JUNIOR INSTITUTION OF ENGINEERS (North-Western Section) (at 16 St. Mary's Parsonage, Manchester), at 7.15.—J. A. Oliver: Industrial Electric Vehicles.

INSTITUTION OF AUTOMOBILE ENGINEERS (Scottish Centre) (at Royal Technical College, Glasgow), at 7.30.—F. G. Woollard: Some Notes on British Methods of Continuous Production.

ROYAL INSTITUTE OF BRITISH ARCHITECTS, at 8.—F. R. Hiorns: The Corporate Spirit in Architecture.

ARISTOTELIAN SOCIETY (at University of London Club), at 8.—R. G. Collingwood: The Nature and Aims of a Philosophy of History.

MEDICAL SOCIETY OF LONDON, at 9.—Sir Bernard Spilsbury: Wounds and other Injuries (Lettsomian Lectures) (III.).

ROYAL SOCIETY OF MEDICINE (Social Evening), at 9.30.—Dr. H. C. Cameron: John Locke, the Philosopher (1690), on the Upbringing of Children.

CHEMICAL INDUSTRY CLUB (at 2 Whitehall Court, S.W.).

TUESDAY, MARCH 17.

ROYAL COLLEGE OF PHYSICIANS OF LONDON, at 5.—Dr. J. A. Ryle: The Study of Gastric Function in Health and Disease (Goulstonian Lectures) (I.).

ROYAL INSTITUTION OF GREAT BRITAIN, at 5.15.—Prof. E. N. da C. Andrade: The Evolution of the Scientific Instrument (II.).

ROYAL STATISTICAL SOCIETY (Royal Society of Arts), at 5.15.—C. W. Hurcomb: Official Railway Statistics in Great Britain.

MINERALOGICAL SOCIETY OF LONDON (at Geological Society), at 5.30.—S. Tomkeieff: The Structure of Aragonite.—E. D. Mountain: Potash-oligoclase from Mt. Erebus, South Victoria Land, and Anorthoclase from Mt. Kenya, E. Africa.—Dr. A. Brammall: Further Notes on the Association of Lime with other Oxides of RO-type in Minerals.

ZOOLOGICAL SOCIETY OF LONDON, at 5.30.—Secretary: Report on the Additions made to the Society's Menagerie during the month of February 1925.—Rev. F. C. R. Jourdain: A Study on Parasitism in the Cuckoo.—C. R. Narazana Rao and B. S. Ramanna: A New Genus of the Family Engystomatidæ (Batrachia).—Dr. Nellie B. Eales: External Characters, Skin, and Temporal Gland of a Fœtal African Elephant.—F. F. Laidlaw: Description of a New Genus and Two New Species of Dragon-flies (Odonata) belonging to the Family Gomphidæ from Tropical Asia.—Rev. Dr. F. J. Wyeth: The Development and Neuromery of the Mid-Brain and Hind-Brain in *Sphenodon punctatus*.

INSTITUTE OF MARINE ENGINEERS, at 6.30.—A. C. Hardy: Motor Passenger Vessels.

INSTITUTION OF ELECTRICAL ENGINEERS (North Midland Students' Section) (at Leeds University), at 7.—W. R. T. Skinner and G. E. Barrett: High-pressure and High-temperature Steam.

INSTITUTION OF ELECTRICAL ENGINEERS (North-Western Centre) (at Engineers' Club, Manchester), at 7.—Col. T. F. Purves: The Post Office and Automatic Telephones.

SOCIETY OF CHEMICAL INDUSTRY (Birmingham and Midland Section) (at Birmingham University), at 7.15.—H. T. Tizard: Address.

ROYAL PHOTOGRAPHIC SOCIETY OF GREAT BRITAIN, at 7.30.—(Annual Meeting of Scientific and Technical Group.)—Dr. T. Slater Price: Some Modern Views on the Sensitivity of Emulsions.

HULL CHEMICAL ENGINEERING SOCIETY (at Grey Street, Hull), at 7.45.—N. Simkin: Some Aspects of Low-Temperature Carbonisation.

ROYAL SOCIETY OF MEDICINE (Pathology Section), at 8.30.—Annual Meeting.

INSTITUTION OF AUTOMOBILE ENGINEERS (Wolverhampton Centre) (at Wolverhampton).

SOCIETY OF DYERS AND COLOURISTS (Leeds Junior Branch) (Annual Meeting) (at Leeds).—Prof. A. G. Perkin: Paper.

WEDNESDAY, MARCH 18.

SOCIETY OF CHEMICAL INDUSTRY (Glasgow Section) (jointly with the Chemical Engineering Group) (at 39 Elmbank Crescent, Glasgow), at 7.—Prof. J. W. Hinchley: Address.

INSTITUTION OF ELECTRICAL ENGINEERS (Sheffield Sub-Centre) (at Sheffield University), at 7.30.—G. F. Jones: Some Considerations in the Design, Manufacture, and Testing of Broadcasting Wireless Receiving Apparatus.

INSTITUTE OF METALS (North-East Section) (at Armstrong College, Newcastle-upon-Tyne), at 7.30.—A. G. Lobley: Electric Furnaces.

ROYAL METEOROLOGICAL SOCIETY, at 7.30.—Sir Napier Shaw and H. Fahmy: The Energy of Saturated Air in a Natural Environment.—C. K. M. Douglas: The Relation between the Source of the Air and the Upper Air Temperature up to the Base of the Stratosphere.—A. H. R. Goldie: Waves at an approximately Horizontal Surface of Discontinuity in the Atmosphere.

ROYAL SOCIETY OF ARTS, at 8.—C. N. Friese-Greene: Colour Cinematography.

ENTOMOLOGICAL SOCIETY OF LONDON, at 8.

INSTITUTION OF AUTOMOBILE ENGINEERS (Birmingham Graduates' Meeting) (at Chamber of Commerce, Birmingham).

SOCIETY OF GLASS TECHNOLOGY (at Newcastle-upon-Tyne).

THURSDAY, MARCH 19.

ROYAL SOCIETY, at 4.30.—Sir William Hardy and Miss Ida Bircumshaw: Boundary Lubrication. Plane Surfaces and the Limitations of Amontons' Law (Bakerian Lecture).

LINNEAN SOCIETY OF LONDON, at 5.—A. S. Hirst: Parasitic Mites found on Lizards.—W. R. B. Oliver: Biogeographical Relations of the New Zealand Region.—Mrs. M. Roach: A Study of the Physiology of certain Soil-Algæ in Pure Culture.

ROYAL COLLEGE OF PHYSICIANS OF LONDON, at 5.—Dr. A. J. Ryle: The Study of Gastric Function in Health and Disease (Goulstonian Lectures) (II.).

ROYAL INSTITUTION OF GREAT BRITAIN, at 5.15.—Dr. Leonard Hill: The Biological Action of Light (II.).

ROYAL AERONAUTICAL SOCIETY, at 5.30.—Capt. F. Tymms: Practical Navigation of Aircraft.

INSTITUTION OF MINING AND METALLURGY (at Geological Society), at 5.30.

CHILD-STUDY SOCIETY (at Royal Sanitary Institute), at 6.—Comdr. B. T. Coote: What the Miners' Welfare Fund is doing for Children and Young People in Mining Communities.

INSTITUTION OF ELECTRICAL ENGINEERS, at 6.—Presentation of the Faraday Medal to Sir J. J. Thomson.—S. Evershed: Permanent Magnets in Theory and Practice.

INSTITUTION OF AUTOMOBILE ENGINEERS (Graduates' Meeting) (at Watergate House, Adelphi), at 7.30.

INSTITUTE OF CHEMISTRY (Bristol Section) (at Bristol University), at 7.30.—Annual Meeting.

NORTH-EAST COAST INSTITUTION OF ENGINEERS AND SHIPBUILDERS (at Bolbec Hall, Newcastle-upon-Tyne), at 7.30.—B. J. Ives: Seaworthiness.

NORTH-EAST COAST INSTITUTION OF ENGINEERS AND SHIPBUILDERS (Middlesbrough Graduates' Section) (at Cleveland Scientific and Technical Institution, Middlesbrough), at 7.30.—E. A. Harroway: British and Foreign Shipyard Practice.

CHEMICAL SOCIETY, at 8.—D. H. Bangham and J. Stafford: The "Activation" of Graphite as a Sorbent of Oxygen.

INSTITUTE OF CHEMISTRY (Edinburgh and East of Scotland Section, jointly with the Society of Chemical Industry (Edinburgh and East of Scotland Section)) (at North British Station Hotel, Edinburgh), at 8.—Informal Meeting.

ROYAL SOCIETY OF TROPICAL MEDICINE AND HYGIENE (Laboratory Meeting) (at Royal Army Medical College, Grosvenor Road, S.W.), at 8.15.—Demonstrations by Drs. D. Adams, A. W. Grace, E. Hindle and J. T. Duncan, H. B. Newham, A. S. Burgess, Col. M. Perry, Drs. H. Seidelin, A. C. Stevenson, J. Gordon Thomson, C. M. Wenyon, and Mr. A. L. Sheather, and Prof. Warrington Yorke.

SOCIETY OF DYERS AND COLOURISTS (West Riding Section).—H. P. Hird: Further Researches on Coal Combustion.

IPSWICH AND DISTRICT NATURAL HISTORY SOCIETY (at Ipswich).—F. J. Chittenden: Experiments with Fruit Trees.

FRIDAY, MARCH 20.

EUGENICS EDUCATION SOCIETY (at Royal Society), at 5.—Dr. J. Brownlee: The Present Tendencies of Population in Great Britain in respect of Quantity and Quality.

ROYAL COLLEGE OF SURGEONS OF ENGLAND, at 5.—Sir Arthur Keith: Demonstration of Specimens illustrating the Surgical Anatomy of the Middle Ear.

ROYAL PHOTOGRAPHIC SOCIETY OF GREAT BRITAIN (Pictorial Group), at 7.—F. C. Tilney: Address.

SOCIETY OF CHEMICAL INDUSTRY (South Wales Section) (Annual General Meeting) (at Technical College, Cardiff), at 7.30.—G. H. Clegg: Chairman's Address.

JUNIOR INSTITUTION OF ENGINEERS, at 7.30.—S. H. Hole: Modern Transport.

INSTITUTE OF METALS (London Local Section) (at Institute of Marine Engineers), at 7.30.—Open Discussion.

ROYAL INSTITUTION OF GREAT BRITAIN, at 9.—Prof. J. W. McBain: Soaps and the Theory of Colloids.

SOCIETY OF DYERS AND COLOURISTS (Manchester Section) (at Manchester).—Dr. F. M. Rowe, A. C. Burns, and J. S. H. Davies: A New Reaction with certain Diazo Sulphonates derived from β-naphthol-1-Sulphonic Acid.

SATURDAY, MARCH 21.

BRITISH PSYCHOLOGICAL SOCIETY (at Bedford College, Regent's Park), at 3.—R. H. Thouless: The Physics of the Psychogalvanic Reflex Phenomenon.—Rev. R. C. McCarthy: The "Determining Tendency" and Conation.

ROYAL INSTITUTION OF GREAT BRITAIN, at 3.—Sir Ernest Rutherford: The Counting of the Atoms (IV.).

INSTITUTE OF BRITISH FOUNDRYMEN (Lancashire Branch: Junior Section) (at Manchester College of Technology), at 7.—H. Stead: Plate Moulding and the Patternmaker.

IPSWICH AND DISTRICT NATURAL HISTORY SOCIETY.—Dr. H. M. Cade: The Germ Theory of Disease (Pathogenic Bacteria).

PHYSIOLOGICAL SOCIETY (Annual General Meeting) (at University College).

PUBLIC LECTURES.

SATURDAY, MARCH 14.

HORNIMAN MUSEUM (Forest Hill), at 3.30.—Dr. R. L. Sherlock: Man as a Geological Agent.

TUESDAY, MARCH 17.

UNIVERSITY COLLEGE, at 5.30.—C. D. Forde: The Megalithic Monuments of Brittany.—Prof. A. C. Seward: The Cretaceous Vegetation of Greenland. (Succeeding Lectures on March 20, 24.)

CASTLE MUSEUM, NORWICH, at 8.—Prof. Adshead: Housing after Slum Clearance (Chadwick Lecture).

UNIVERSITY, LEEDS, at 8.—E. Percival: The Freshwater Zoology of Yorkshire.

WEDNESDAY, MARCH 18.

KING'S COLLEGE, at 5.30.—Prof. J. D. Wilson: Education and Industrial Democracy.

FRIDAY, MARCH 20.

UNIVERSITY COLLEGE, CARDIFF, at 7.—Dr. W. M. Feldman: Ante-Natal Child Physiology and Hygiene (Chadwick Lecture).

SATURDAY, MARCH 21.

UNIVERSITY COLLEGE, at 3.—Dr. F. M. Feldman: Post-Natal Child Physiology and Hygiene (Chadwick Lecture).

HORNIMAN MUSEUM (Forest Hill), at 3.30.—S. Hazzledine Warren: Who were the First Men?